VOL. XVII DECEMBER, 1933 No. 6

The Journal of APPLIED PSYCHOLOGY

JAMES P. PORTER, EDITOR
Ohio University
WITH A BOARD OF CO-OPERATING EDITORS

TABLE OF CONTENTS

DAVID SEGEL and J. R. GERSTRICH. Differential College Achievement Predicted by the American Council Psychological Examination 637

WALTER CROSBY EELLS. Educational Achievement of the Native Races of Alaska 646

J. ELBERT CHADWICK. Predicting Success in Sight-Singing 671

KEITH SWARD. Jewish Musicality in America 675

EDWARD B. GREENE. The Legibility of Typewritten Material 713

HERBERT SORENSON. Mental Ability Over a Wide Range of Adult Ages 729

R. C. DAVIS and HANSEL J. SMITH. Determinants of Feeling Tone in Type Faces 742

C. H. SMELTZER. Objective Measurement of Applied Information 765

News and Notes 772

Book Reviews 775

New Books and Pamphlets 777

Index 779

PUBLISHED BI-MONTHLY BY THE EDITOR
Ohio University, Athens, Ohio
Printed by
C. E. PAULEY & COMPANY, INC.
225 N. New Jersey St., Indianapolis, Indiana

Entered as second-class matter at the post office at Athens, Ohio, under the act of March 3, 1879. Additional entry as second-class matter at the post office, Indianapolis, Indiana.

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The Journal of Applied Psychology

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THE JOURNAL OF APPLIED PSYCHOLOGY is published bi-monthly. The subscription price is $5.00 a year. Single numbers $1.00 to $2.00, depending upon the number of pages. Remittances and business communications should be addressed to the Editor, James P. Porter, Ohio University, Athens, Ohio.

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VOLUME XVII
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PUBLISHED BY THE EDITORS
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CONTENTS

H. F. ADAMS. A Scale for Measuring Psychological Phenomena ---------- 239

GRACE ARTHUR. The Predictive Value of the Kuhlmann-Binet Scale for Inmates of a State School for the Feebleminded ---------- 188

F. S. BEERS: See Bird and Beers.

ISABEL R. BERMAN and CHARLES BIRD. Sex Differences in Speed of Reading ---------- 221

CHARLES BIRD and F. S. BEERS. Maximum and Minimum Inner Speech in Reading ---------- 182

CHARLES BIRD: See Berman and Bird.

PAUL L. BOYNTON and F. A. FORD. The Relationship between Play and Intelligence ---------- 294

JOSEPHINE D. BRAMKAMP: See Broom and Bramkamp.

M. E. BROOM and JOSEPHINE D. BRAMKAMP. A Study of Factors Contributing to School Citizenship ---------- 459

R. A. BROTEMARKLE. What the Bernreuter Personality Inventory Does Not Measure ---------- 559

J. ELBERT CHADWICK. Predicting Success in Sight Singing ---- 671

C. M. CHARLES. A Comparison of the Intelligence Quotients of Three Different Mental Tests Applied to a Group of Incarcerated Delinquent Boys ---------- 581

EDWARD E. CURETON. The Standard Error of the Average Intercorrelation and of the Average Criterion Correlation ---------- 70

MARCUS A. CURRY. See Gaudet and Curry.

R. C. DAVIS and HANSEL J. SMITH. Determinants of Feeling Tone in Type Faces ---------- 742

RALEIGH M. DRAKE. Four New Tests of Musical Talent ---------- 136

RALEIGH M. DRAKE. The Validity and Reliability of Tests of Musical Talent ---------- 447

GEORGE J. DUDYCHA. The Religious Beliefs of College Students ---------- 585

STANLEY DULSKY. Factors Influencing the Amount of Copy Read in Magazine Advertisements ---------- 195

MERWIN A. DUREA. An Experimental Study of Attitudes Toward Juvenile Delinquency ---------- 522

WALTER CROSBY EELLS. Mental Ability of the Native Races of Alaska ---- 417
WALTER CROSBY EELLS. Mechanical, Physical, and Musical Ability of the Native Races of Alaska ---- 493
WALTER CROSBY EELLS. Educational Achievement of the Native Races of Alaska ---- 646
MARION ELDERTON. An Experiment in Map Scoring and Mental Imagery Tests ---- 376
ALVIN C. EURICH. The Photographic Eye-Movement Records of Successful and Unsuccessful College Students ---- 604
ADELBERT FORD. Motion Analysis by the use of Stereoscopic Motion Pictures ---- 407
F. A. FORD: See Boynton and Ford.
RALPH A. FRITZ. Predicting College Marks and Teaching Success for Students in a Teachers College ---- 439
DOROTHY A. GARDNER: See Garth, Ikeda and Gardner.
THOMAS R. GARTH, KUNEHEI IKEDA and DOROTHY GARDNER. Japanese Work Curves ---- 331
HAROLD V. GASKILL. Broadcasting versus Lecturing in Psychology: Preliminary Investigation ---- 317
FREDERICK J. GAUDET and MARCUS A. CURRY. The Effects of Business Conditions upon the Sanity of a Population ---- 130
J. R. GERBERICH: See Segel and Gerberich.
H. NELSON GILBERT. An Experiment with Colored and Uncolored Advertisements ---- 49
EDWARD B. GREENE. The Legibility of Typewriter Script ---- 713
STEPHEN HABBE. The Selection of Student Nurses ---- 564
GEORGE W. HARTMANN. The Interview as a Research and Teaching Device ---- 205
ARNOLD H. HILDEN. A Comparative Study of Intelligence Quotients and Heinis' Personal Constant ---- 355
G. W. HOLCOMB: See Rogers and Holcomb.
KUNEHEI IKEDA: See Garth, Ikeda and Gardner.
A. M. JORDAN. Parental Occupations and Children's Intelligence Scores ---- 103
DAVID KAPLUN. The Feeling Tone of Adjectives ---- 63
WILFRED H. KERR and JAMES D. WEINLAND. Muscular Perceptivity as a Trade Test ---- 550
L. B. KINNEY. The Relationship of Certain Factors to Success in Clerical Positions ---- 55
HARRY DEXTER KITSON. A Further Study of the Turnover of Psychologists ---- 542
DONALD A. LAIRD. The Influence of Noise on Production and Fatigue ---- 320

HARVEY C. LEHMAN. A Class Experiment in the Transfer of Training ---- 77
OSCAR LITTERER. An Experimental Study of Visual Apprehension in Reading ---- 266
MARGARET LORANZ: See Omwake and Loranz.
LUMLEY, F. H. Habits of the Radio Audience ---- 29
HOWARD Y. MCCLUSKY. An Experimental Comparison of the New Type Test and the Term Paper ---- 621
EDNA WILLIS MCELWEE. Further Standardization of the Ellis Memory for Objects Test ---- 68
JOHN A. MCGEOCH. The Configurational Psychology of Learning ---- 83
FRIEDA KIEFER MERRY: See Merry and Merry.
RALPH V. MERRY and FRIEDA KIEFER MERRY. The Tactual Recognition of Embossed Pictures by Blind Children ---- 148
CLAUDE L. NEMZEK. The Comparative Constancy of Stanford-Binet and Herring-Binet IQ's ---- 475
KATHERINE T. OMWAKE and MARGARET LORANZ. Study of Ability to Wake at a Specified Time ---- 468
MARJORIE LOU PAGE. The Mechanical Ability of Subnormal Boys ---- 164
JAMES R. PATRICK and EMMETT ROWLES. Intercorrelations Among Metabolic Rate, Vital Capacity, Blood Pressure, Intelligence, Scholarship, Personality and Other Measures on University Women ---- 507
LUELLA COLE PRESSEY: See Pressey and Pressey.
SIDNEY L. PRESSEY and LUELLA COLE PRESSEY. Development of the Interest-Attitude Tests ---- 1
SIDNEY L. PRESSEY and LUELLA COLE PRESSEY. Results of Certain Honesty Tests Given to a Group of Rural White Children and to Two Groups of Indian Children ---- 120
SIDNEY L. PRESSEY and LUELLA COLE PRESSEY. A Comparative Study of the Emotional Attitudes and Interests of Indian and White Children ---- 227
SIDNEY L. PRESSEY and LUELLA COLE PRESSEY. A Comparison of the Emotional Development of Indians Belonging to Different Tribes ---- 535
SIDNEY L. PRESSEY and LUELLA COLE PRESSEY. A Study of the Emotional Attitudes of Indians Possessing Different Degrees of Indian Blood ---- 410
H. H. REMMERS: See Salner and Remmers.
JESSE BATLEY RHINEHART. An Attempt to Predict the Success of Student Nurses by the Use of a Battery of Tests ---- 277

H. S. ROGERS and G. W. HOLCOMB. An Inventory of Engineering Motives ---- 302
EMMETT ROWLES: See Patrick and Rowles.
E. SALNER and H. H. REMMERS. Affective Selectivity and Liberalizing Influence of College Courses ---- 349
NORMA V. SCHEIDEMANN. Multiplying the Possibilities of the Multiple Choice Form of Objective Question ---- 337
DAVID SEGEL and J. R. GERBERICH. Differential College Achievement Predicted by The American Council Psychological Examination ---- 637
HELEN S. SHACTER. Intelligence as a Causal Factor Determining Differences in Sustained Attention in Preschool Children ---- 478
C. H. SMELTZER. Objective Measurement of Applied Information ---- 765
HANSEL J. SMITH: See Davis and Smith.
JOHN J. SMITH. What One College Thinks Concerning War and Peace ---- 17
HERBERT SORENSON. Mental Ability Over a Wide Range of Adult Ages ---- 729
KEITH SWARD. Jewish Musicality in America ---- 675
ROBERT P. WAGNER. An Experiment with the Number Maze as a Measure of Learning ---- 614
JAMES D. WEINLAND: See Kerr and Weinland.
CARROLL A. WHITMER. A Study of the Scholastic Progress of College Probationers ---- 39

DIFFERENTIAL COLLEGE ACHIEVEMENT PREDICTED BY THE AMERICAN COUNCIL PSYCHOLOGICAL EXAMINATION

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There is need for the evaluation of general predictive instruments in terms of their capacities for differential prediction of scholastic success in college.[1] Many colleges and universities are using the American Council Psychological Examination or somewhat similar tests for purposes of admission or prediction of general scholastic success and for the prediction of success in specific college subjects. Some studies have reported the general predictive power for first semester college scholarship of such tests when given during the senior year of high school.[2]

There are many other specialized tests being introduced in colleges to aid in orientation. Many of these more specialized tests will no doubt be found useful in differential prediction. Moreover, in so far as possible the measuring instruments which are used for purposes of

[1] The general description of the differential predictive method is found in the following reference: David Segel, "Differential Prediction of Ability as Represented by College Subject Groups," *Journal of Educational Research*, 25:14-26, 93-98, January and February, 1932.

[2] Such as, for example: J. R. Gerberich, "Validation of a State-Wide Educational Guidance Program for High School Seniors," *School and Society*, 34:606-610, October 31, 1931.

general prediction should be analyzed also for more specific purposes. This study reports an attempt to analyze the American Council Psychological Examination for its value in differential prediction.

For the purpose of analyzing the differential predictive value of a general measure of scholastic aptitude such as the American Council test, use has been made of test results from a previous, more general investigation.[3] The original data from this study made possible the calculation of correlation coefficients between scores on the various parts of the American Council test and first semester scholastic success in college English, foreign languages and mathematics. The following subject or subject aptitude tests were also included in the battery of tests which was given to a large number of seniors in Arkansas high schools: (a) fifty-minute English examination consisting of a 60-item test on punctuation and grammar and a 45-item test of sentence sense or ability to distinguish between basic types of word grouping, (b) the foreign language aptitude examination of the Iowa Placement Examination series, and (c) a sixty-five minute mathematics examination composed of sections dealing with arithmetic, algebraic manipulations, and algebraic problems. Reliability coefficients of .87, .97, and .89 were obtained for the English, foreign language, and mathematics tests respectively.

The intercorrelation coefficients for these tests and their correlation coefficients with college marks in English, foreign languages, and mathematics are given in Table I for the 354 students who took all tests and who were followed through their first semester of college attendance.

[3] J. R. Gerberich, op. cit.

TABLE I

*Intercorrelation Coefficients between Scores on Parts of the American Council Test and Test Scores for English, Foreign Languages, and Mathematics.**

Test	No. of cases	Amer. II	Coun. III	Psych. IV	V	Engl.	For. Lang.	Math.
Amer. Council I	354	.444	.414	.477	.609	.438	.550	.307
Amer. Council II	354		.489	.279	.579	.654	.748	.380
Amer. Council III	354			.409	.406	.380	.436	.472
Amer. Council IV	354				.355	.281	.378	.616
Amer. Council V	354					.517	.696	.350
English	354						.704	.349
Foreign Language	207							---**
Mathematics	147							

* All coefficients positive.

** No correlation coefficient could be obtained for relationship as no students took both the foreign language and mathematics tests.

Table II furnishes data concerning the correlation coefficients between test scores and first semester marks in college, and intercorrelation coefficients between first semester marks.

TABLE II

*Correlation Coefficients between Test Scores and Subject Marks and between Marks in Various Subjects**

Test or Marks	English Marks		For. Lang. Marks		Math. Marks	
	No.	r	No.	r	No.	r
Amer. Council I	340	.408	128	.192	90	.329
Amer. Council II	340	.543	128	.384	90	.433
Amer. Council III	340	.379	128	.246	90	.314
Amer. Council IV	340	.201	128	.137	90	.378
Amer. Council V	340	.509	128	.322	90	.364
English	340	.577	128	.461	90	.409
Foreign Language	199	.593	128	.519	--	---**
Mathematics	141	.328	---	---**	90	.600
English Marks			126	.561	90	.397
For. Lang. Marks					--	---**

* All coefficients positive.

** See second footnote to Table I.

Table III presents the remaining basic information to this investigation—the standard deviations in terms of class intervals for certain of the subject tests and marks.

TABLE III

Standard Deviations for Distributions of Test Scores and Subject Marks, in Terms of Class Intervals Used in Calculating Correlation Coefficients.

Test or Marks	No. of Cases	Standard Deviation
English	354	3.75
Foreign Language	207	3.66
Mathematics	147	3.62
English Marks	340	2.03*
Foreign Language Marks	128	1.92*
Mathematics Marks	90	2.50*

* Based on a weighted grade point or measure of scholastic success where A = 6, B = 4, C = 2, D = 0, E = –1, and F = –2.

The correlation coefficients given in these tables are direct correlations of test scores with success criteria. The conversion of such data into differential prediction data is made by the formula

$$r_{(a-b)x} = \frac{r_{ax}\sigma_a - r_{bx}\sigma_b}{\sqrt{\sigma_a^2 + \sigma_b^2 - 2r_{ab}\sigma_a\sigma_b}}$$

where r_{ax} is the correlation between a prediction item, x and one success criterion, a; where r_{bx} is the correlation between the same prediction item and another success criterion, b; and where r_{ab} is the correlation between the two success criteria. The values σ_a and σ_b refer to the standard deviations of the distributions of the a and b scores respectively, expressed in the same intervals as were used in the calculation of r_{ax} and r_{bx}. The coefficient $r_{(a-b)x}$ is the differential correlation coefficient between

* J. Murray Lee and David Segel, "The Utilization of Data For Simple or Direct Prediction in the Development of Differential Prediction Regression Equations." *Journal of Educational Psychology*, Vol. XXIV: 7:550-54, Oct. 1933.

a prediction item, x, and the difference between two success criteria, a and b.

The first step in this study was to calculate the differential correlation coefficients which indicate the possibilities of value in three types of relationships: English marks compared with foreign language marks, English marks compared with mathematics marks, and foreign language marks compared with mathematics marks, for each part of the American Council test. The following illustration shows the use of the formula given above in the first of the three relationships.

From Tables I, II, and III were obtained the following data which are necessary for the estimation of the possibilities of predicting a difference between English and foreign language marks in college by use of the first part of the American Council test.

Correlation coefficients:

American Council test, Part I with English marks	.408
American Council test, Part I with foreign language marks	.192
English marks with foreign language marks	.561
Standard Deviations:	
English Marks	2.03
Foreign language marks	1.92

Substituting these values in the formula given above the following is obtained

$$r_{(a-b)_x} = \frac{.408\ (2.03) - .192\ (1.92)}{\sqrt{(2.03)^2 + (1.92)^2 - 2(.561)\ (2.03)\ (1.92)}} = .25$$

The differential correlation coefficients for all three differences in marks possible with these data are given in Table IV for all five parts of the American Council test. A correlation coefficient of .50 is used between marks in the foreign languages and mathematics. This

is an estimated coefficient because this relationship was not involved in the original accumulation of data. It is thought to be a reasonable estimate, however, and it is probable that very little error is introduced into the study by its use. The correlation coefficient of .25 in the first column indicates that scores on the Completion Test, Part I of the American Council test, are related by that degree to a difference in marks between English and foreign languages in favor of English. The other correlation coefficients are read similarly. These coefficients indicate that scores on the various parts of the American Council test are related, although to a rather slight degree, to differences between marks in the different college subjects. If conclusions were to be drawn from these data alone it would be necessary to conclude that the American Council test has very little power of differentiation. However, since teachers' marks do not have high reliability, this conclusion is subject to further investigation.

Further consideration of these data shows that, since tests in English, foreign language, and mathematics were

TABLE IV

Differential Correlation Coefficients between the Parts of the American Council Psychological Examination and English, Foreign Language, and Mathematics Marks in College.

American Council Test	Differences between Marks in English and Foreign Language	English and Mathematics	Foreign Language and Mathematics
Part I			
Completion	.25	.00	−.20
Part II			
Artificial Language	.20	.00	−.15
Part III			
Analogies	.16	.00	−.14
Part IV			
Arithmetic	.07	−.18	−.30
Part V			
Opposites	.23	.05	−.13

given at the same time as the American Council Psychological Examination, relationships can be determined between scores on the parts of the American Council test and the differences between the scores on these three other tests. These subject tests have a much higher reliability than teachers' marks, so that the relationships found should more closely approximate the true relationships than in the cases where marks are used. The relationships between tests given as parts of the same test battery do not give differential prediction correlation coefficients, in the strict sense of the word. Such coefficients do not represent the projection of success in the future. However, since general abilities such as are here concerned are somewhat constant from year to year, present relationships may also be considered as predictive. In a more strict sense, these relationships are concerned with a differential diagnosis. The differential correlation coefficients showing the relationships between each part of the American Council test and the differences between the results on the tests in English, foreign language, and mathematics were calculated. All of the data were taken from Tables I, II, and III, except that the relationship between foreign language and mathematics marks was assumed to be expressed by a correlation coefficient of .50. The results are given in Table V.

The correlation coefficients of Table V indicate that the parts of the American Council test are to some extent instruments for differential prediction or differential diagnosis. Parts II, IV, and V give the most significant differential correlation coefficients. These parts show relationships, in particular, to differences between scores on the English and mathematics tests and between scores on the foreign language and mathematics tests. Part II is the Artificial Language Test. This part comes out in favor of English as against mathematics and in favor of foreign language as against mathematics, as indicated by the coefficients of .27 and .37 for the two relationships.

The results with Part IV, the Arithmetic Test, come out in favor of mathematics in comparisons with both English and foreign languages, as shown by the coefficients of .27 and .24. Part V, which is an opposites test, is

TABLE V

Differential Correlation Coefficients between the Parts of the American Council Psychological Examination and Aptitude or Training Tests in English, Foreign Language, and Mathematics.

American Council Test	Differences between Marks in English and Foreign Language	English and Mathematics	Foreign Language and Mathematics
Part I			
Completion	−.13	.05	.15
Part II			
Artificial Language	−.10	.27	.37
Part III			
Analogies	−.06	−.06	−.04
Part IV			
Arithmetic	−.11	−.27	−.24
Part V			
Opposites	−.22	.17	.35

more closely related to English than mathematics, as shown by the correlation coefficient of .35.

The multiple correlation coefficients calculated for parts of the American Council test are given below for the two of the possible three relationships which are significant.

Difference	Prediction Items	Multiple Correlation Coefficient
English Test Scores minus Mathematics Test Scores	Parts II, IV, and V, Amer. Council Test	.467
Foreign Language Test Scores minus Mathematics Test Scores	Parts II, IV, and V, Amer. Council Test	.582

SUMMARY AND CONCLUSIONS

The American Council Psychological Examination was analyzed for its possible use in differentiating the ability

of students to do college work and their ability to do work in the specific subjects of English, foreign languages, and mathematics. This was done by calculating differential correlation coefficients between scores on the various parts of the American Council test and differences between college marks in English, foreign languages, and mathematics, which were obtained at the same time as the results on the American Council test.

The correlation coefficients between scores on the parts of the American Council test and the differences between college marks were zero or negligibly small. The correlation coefficients between scores on the parts of the American Council test and the differences between scores on tests taken at the same time, although low, seemed to be stable. Multiple correlation coefficients of .467 and .582 were found between three parts of the American Council test and differences between English and mathematics test scores and differences between foreign language and mathematics test scores respectively.

It may be concluded that the American Council test should not be used for differential prediction purposes when college marks are the criteria, since its power for such use is negligible. It has been shown elsewhere[4] that carefully chosen specific tests may be used to make a differential scholastic prediction at this level about as well as general psychological tests, such as the American Council, predict general scholastic success.

If, however, the ability of students is measured by objective tests, certain parts of the American Council test, (II, IV, and V) show some differentiating power. This leads to the conclusion that it may be possible to so select tests for a general battery of the type of the American Council Psychological Examination that it will have differential predictive power and at the same time direct predictive power.

[4] David Segel, op. cit.

EDUCATIONAL ACHIEVEMENT OF THE NATIVE RACES OF ALASKA

WALTER CROSBY EELLS
Stanford University

In earlier articles the writer has reported upon the mental, mechanical, physical, and musical abilities of the native races of Alaska, and has described the methods used in collecting the objective data, the adequacy of the sampling, and the conditions and limitations upon the testing program.[1] The present article will be devoted to a summary of the results of the effort to measure the actual success of the children of the Eskimo, Aleut, and Indian races in the curriculum of the schools provided for them by the United States Government. The greater part of the article will deal with measurements made by means of a general achievement test. Brief treatment will be given to supplementary measures of handwriting, English composition, and music.

[1] Walter Crosby Eells, "Mental Ability of the Native Races of Alaska," *Journal of Applied Psychology*, (August, 1933), Vol. XVII, pp. 417-438.

Walter Crosby Eells, "Mechanical, Physical, and Musical Ability of the Native Races of Alaska," *Journal of Applied Psychology*, (October, 1933), Vol. XVII, pp. 493-506.

For a complete report of the three-year investigation of Federal education for the natives of Alaska, see H. Dewey Anderson and Walter Crosby Eells, *Federal Education in Alaska: A Study of the Administrative, Curricular, Economic, and Sociological Aspects of the Work of the United States Government for the Eskimo, Aleuts, and Indians of Alaska, 1930-32.* To be published by Stanford University Press. Dr. Anderson was Director of the Survey. The writer was Associate Director and especially responsible for the testing program.

In the articles already referred to it was shown that the average intelligence quotient of the three native races of Alaska, as determined by the Stanford-Binet Scale, was from 75 to 80; that when allowance was made for the linguistic factors in the Stanford-Binet it was probable that the true ability of those tested was from ten to fifteen points higher. Since the curriculum of the schools as at present organized is largely a copy of schools in the States and thus strongly linguistic in character, the lower figure for the intelligence quotient is probably the one that should be accepted in studying the actual achievement of the children in mastering the work of the schools as organized.

The practical questions of the present ability and scholastic achievement of these races are of chief concern in attempting improvements. From this standpoint it makes little difference whether such divergent abilities as have been found are native or acquired if the presence of these abilities, in quantities measurable by American measuring devices, is essential to success in the school system as it now exists. When we know beyond reasonable doubt that Eskimo and Aleut children actually measure appreciably lower than American children when measured with the same instruments in each of several different fundamental abilities, very valuable basic information is at hand to use in planning a type of curriculum, methods of instruction, and preparation of teachers which will assure a school system better adapted to their special abilities and limitations. When we find objective evidence that they are failing to meet the requirements of the existing curriculum, the need for extensive revision is further accentuated. This paper, then, will be devoted to answering the question. How well have the native children of Alaska, especially the Eskimo and Aleuts, succeeded with the school work which they have been attempting to do?

A. Stanford Achievement Test—General Analysis

The test upon which major dependence was placed for measuring the scholastic achievements of the Alaskan native children was the New Stanford Achievement Test, Form V, a comprehensive series of ten separate tests designed to cover the principal phases of the school curriculum. Most of the children tested in Alaska were not previously familiar with this type of short-answer, objective test. In order to overcome this handicap as far as possible a pre-test, composed of simple questions of the various types, was designed and given to the children first. Ample time was taken to explain the type of answers desired and to see that the forms were understood.

At first it was thought it would be wise to modify the tests by substituting terms and concepts in common use for those less familiar in Alaska and some preliminary work was done with natives with this in mind. It was found to be impracticable, however, not only because of expense and lack of standardization, but also because conditions varied so much among the Eskimo, Aleuts, and Indians themselves that three or more variations would have been required instead of one. Furthermore, since the course of study as prescribed for the native schools, whether wisely or not, is essentially like that in the States, the test in its original form was deemed best suited to measure the actual success of the children in mastering this curriculum.

General Summary of Achievement.—A general summary of the results of testing school achievement with the New Stanford Achievement test is given in Figure I for the Eskimo, Aleut, and Indian children. Norms are represented by the dotted lines. Since the time of testing was variable throughout the year, the average portion of a grade covered by the entire group was found and the norm as plotted corresponds to this figure. Across the

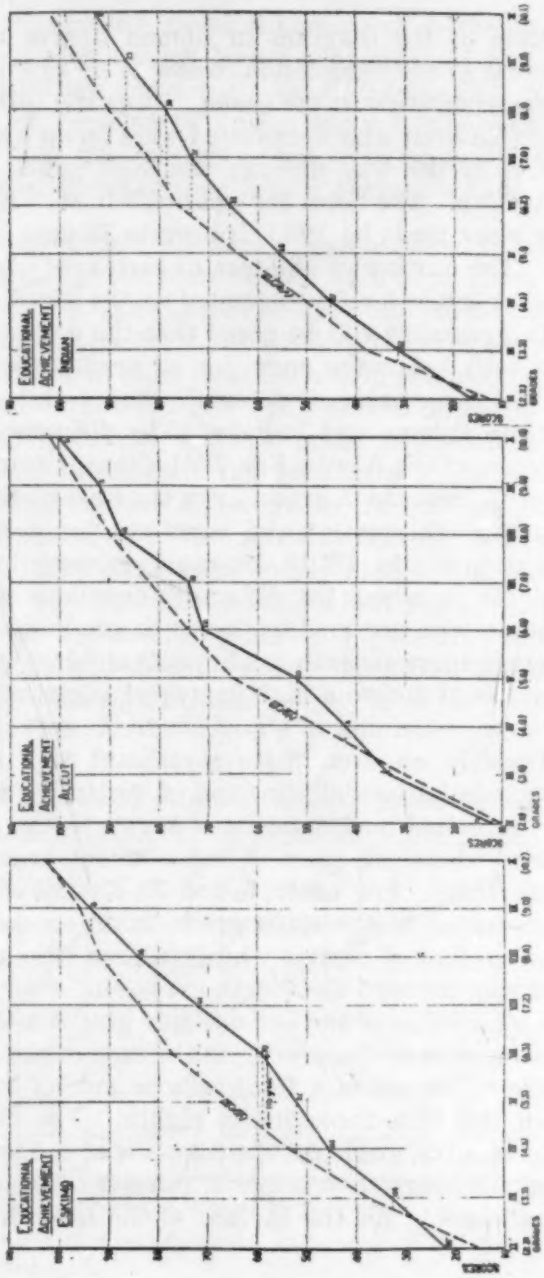


FIGURE I

General Summary of Educational Achievement of Eskimo, Aleut, and Indian Children as Measured by the Stanford Achievement Test

bottom of the diagram in Roman figures is given the general grade designation, below it in Arabic the actual average position in the grade. Thus the third-grade Eskimo children who were tested were on an average three-tenths of the way through the third grade at the time of testing. The norm for grade 3.3 is 38, while the average score made by 108 third-grade Eskimo children was 32. The number of children of each race taking the test at each grade level is indicated on the graph.

In general it will be noted that the accomplishment is distinctly below the norm for all grades above the third for all three races, and for all grades above the second for the Eskimo and Indians. The difference is least in the case of the Aleuts. For the Indians it increases steadily with increase in grade. For the Eskimo the difference between achievement and norm reaches a maximum at the sixth grade. With the rapid decrease in number of children in school the difference decreases until the five Eskimo who survived to the tenth grade made the same average score as tenth grade white children in the States. There is of course a high degree of selection for the few children remaining in school above the seventh grade.

Possibly an even more significant way to read the graphs is horizontally instead of vertically, as suggested by the dotted horizontal lines drawn to the norms from points where the lines of achievement cross successive grade lines. For example the 70 Eskimo children who were tested in the sixth grade made an average score equal to that of normal white children who are less than half way through the fourth grade—in other words they are retarded over one and one-half grades as far as grade classification is concerned. In the case of the Eskimo this grade difference is a full grade or more for each grade from the fifth through the eighth. The only place it reaches a full grade for the Aleuts is at the seventh grade level (although the number of cases is too small for much significance); for the Indians at the seventh and higher

grades. In comparing racial achievement it should be borne in mind that a much larger proportion of Eskimo are in small village day schools than was the case with the children of the other two races whom it was possible to test, and that the Indians tested were largely a distinctly superior group at the Sheldon Jackson school.

Retardation.—Grade deficiency was secured by subtraction of actual grade placement of each pupil from his grade achievement as measured by the Stanford Achievement test. Almost half (48 per cent) of the entire group of pupils were found to be retarded a half grade or more, while only one-eighth (12 per cent) were accelerated. It was found that it requires the average native child almost two years to complete the work of a single school grade and win promotion as judged by the grading practices actually existing in the Alaskan schools; if grade placement is judged by scores on the Stanford Achievement test this time becomes two and a half years instead. These facts are shown graphically in Figure II. Where a child under normal conditions entering school at age 6 would complete the eighth grade at age 14, under present

FIGURE II

Age-Grade Progress of Pupils in Alaskan Native Schools

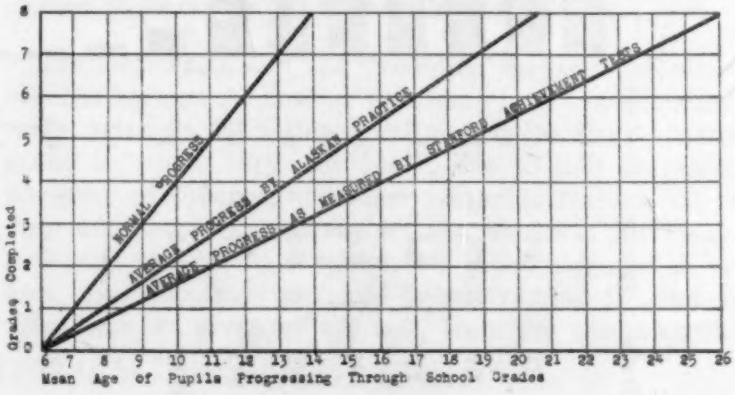
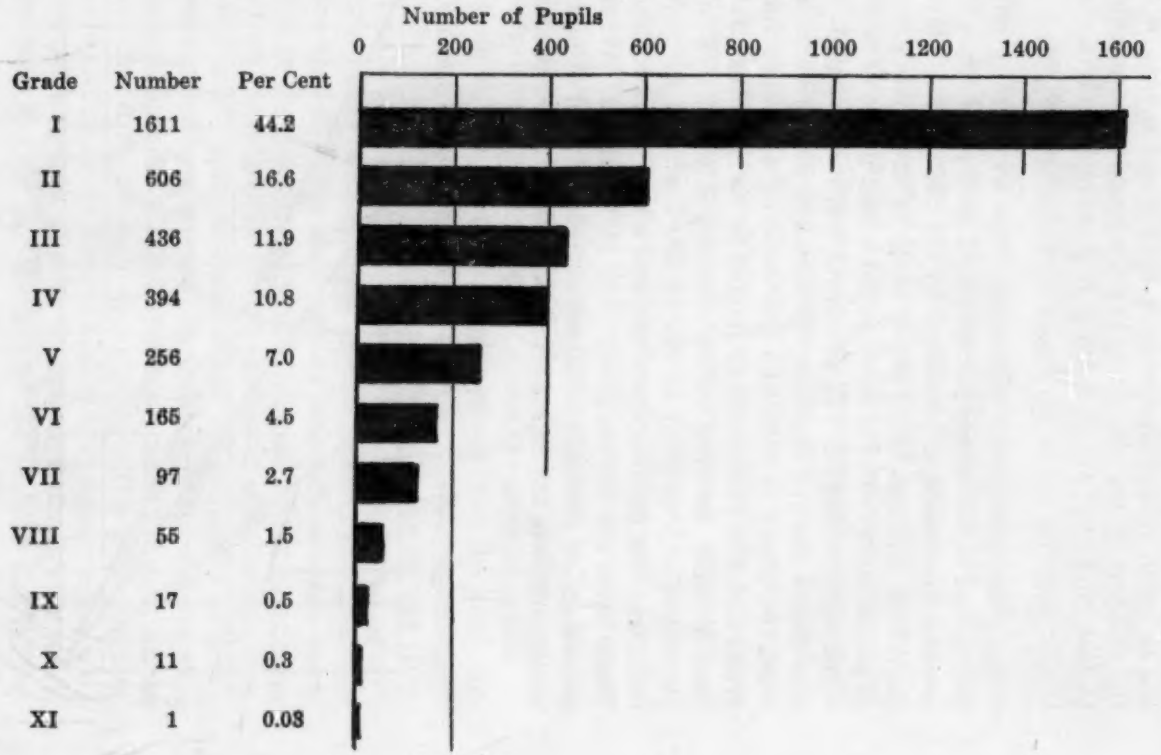

NORMAL PROGRESS
AVERAGE PROGRESS BY ALASKAN PRACTICE
AVERAGE PROGRESS AS MEASURED BY STANFORD ACHIEVEMENT TESTS
Grades Completed
0 1 2 3 4 5 6 7 8
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Mean Age of Pupils Progressing Through School Grades

FIGURE III

School Enrollment by Grades for Eskimo, Aleut, and Indian Pupils in the United States Government Schools for the Natives of Alaska, 1929-30



Grade	Number	Per Cent
I	1611	44.2
II	606	16.6
III	436	11.9
IV	394	10.8
V	256	7.0
VI	165	4.5
VII	97	2.7
VIII	55	1.5
IX	17	0.5
X	11	0.3
XI	1	0.03

existing conditions in the Alaskan native schools he would complete it at age 21; whereas if completion of the eighth grade were judged by the appropriate scores on the Stanford Achievement test he would complete it at age 26. Since few of the children remain in school beyond age 15 or 16 it means that their average education is only of the third or fourth grade level. The excessive retardation is shown in different form in Figure III, which exhibits the relative enrollment in the different grades for the entire native school system of the Territory. Almost half of the total enrollment is in the first grade!

Relation of Grade Deficiency to Blood Purity.—In the study of mental ability of the Alaskan native children[2] it was shown that there was a steady increase in average IQ with increasing proportions of white blood. The same trend is found when a study is made of the relation of grade deficiency to blood purity. This is shown in Figure IV, for the Eskimo and Indians. The trend for the Aleuts is slightly downward. When the three races are combined, however, to secure the greater reliability resulting from larger populations, the averages occupy the position shown by the circled dots. If zero deficiency be assumed as characteristic of a normal white population, these four circled dots are seen, as in the case of the IQ studies, to lie quite close to the "theoretical" line.

Age Deficiency.—In the preceding sections the analysis has been on the basis of deficiency in grade. In many cases, however, the children are greatly over age for the grade in which they are found, due to late entrance, irregular attendance, and other retarding factors. It is desirable, therefore, to consider the results of the measurements secured by the Stanford Achievement test by age. Age deficiency is found by subtracting the educational age, as given by the test, from the chronological

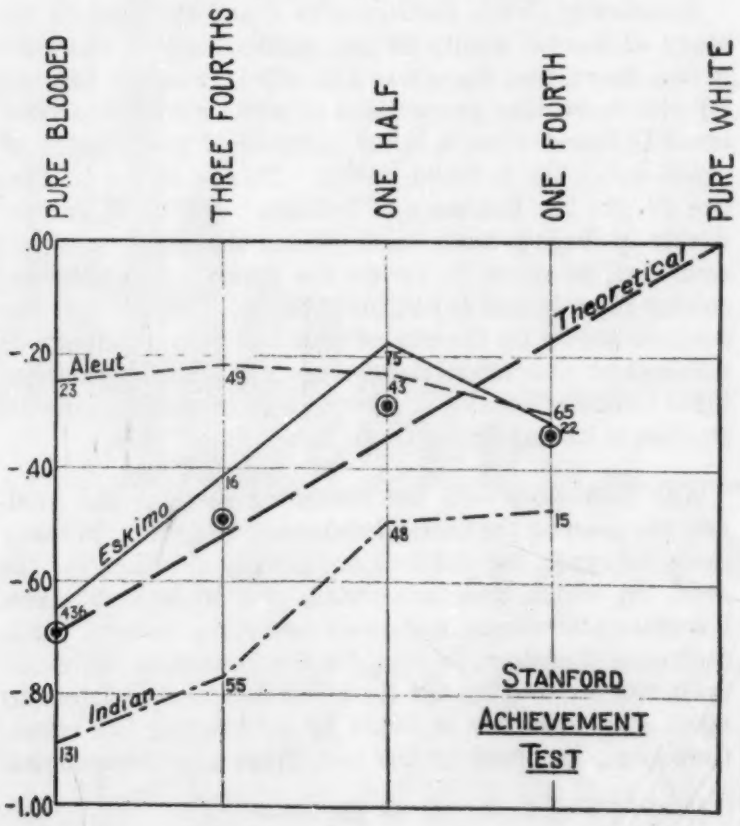
[2] Eells, Walter Crosby, *op. cit.* pp. 434-36.

age. When this is done, the average deficiency is over four years. In the village schools it is 47 months; in the industrial schools where the average age of pupils is 2.5 years greater, it is 55 months.

FIGURE IV

Relation of School Achievement, as Measure by the New Stanford Achievement Test, to Degree of Racial Purity for Eskimo, Aleut, and Indian Children

(Vertical scale shows deficiency, in grades)



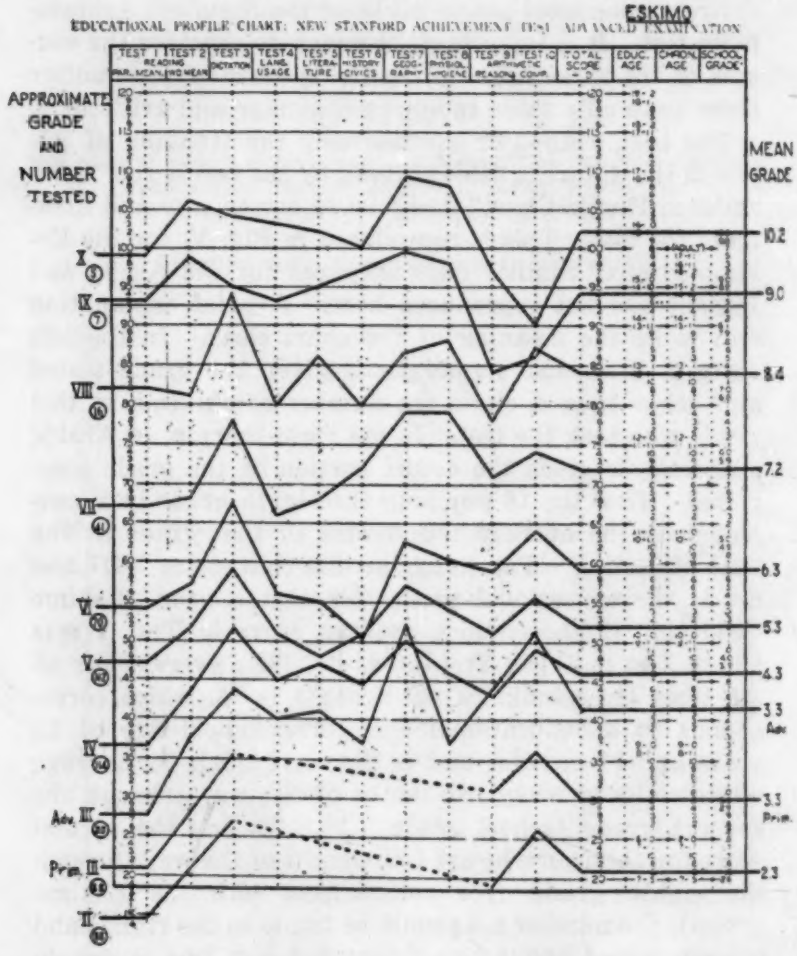
B. Stanford Achievement Test—Special Fields

The analysis up to the present point has been based entirely upon total scores made on the Stanford Achievement test. It is important, however, to consider the success of the three races in the ten specific subject matter tests, especially those involving language and arithmetic.

The best method of summarizing the standing of pupils in the different fields covered by the test is the "Educational Profile Chart" designed to accompany and illustrate the test. This is reproduced in Fig. V, for the Eskimo group. Similar ones prepared for the Aleuts and Indians are not reproduced here. A brief explanation will make the meaning of the chart clear. In the left margin, in Roman numerals, is given the grade tested and below it in a circle the number of children in this grade who took the test. In the right margin, in Arabic numerals, is given the actual portion of the grade completed. Thus the 16 pupils in the eighth grade had completed on the average four-tenths of that grade at the time of testing. The irregular line connecting VIII and 8.4 is the educational profile for eighth grade Eskimo children. It shows their average score in Test 1 was 82; in Test 2, 81; in Test 3, 94, etc. The average for all ten tests (in column "Total Score") is 84, which corresponds to an educational and chronological age of 12 years and 11 months, and is the score made by average white children when two-tenths of the way through the seventh grade (school grade, 7.2). To find the normal score for children who are four-tenths of the way through the eighth grade (for comparison with the Eskimo group), the number 8.4 should be found in the right hand column. Just above this figure a heavy line is drawn across the page. This indicates that the average total score of such children should be, if up to standard, 92 (920 ÷ 10) in the total test, and also 92 in each of the ten sub-tests of accomplishment in special subjects. Thus

FIGURE V

Summary by Grades of Average Scores of Eskimo Children on Each School Subject Included in the New Stanford Achievement Test



the average eighth grade Eskimo may be seen to be deficient 10 points in paragraph meaning, 11 points in word meaning, etc. On the other hand he is two points higher than the white norm in Test 3, "Dictation," which is a

test of spelling. In all other tests he is deficient by varying amounts and on the whole has a deficiency of 8 points on the total score. The norm for any other grade can be located and studied similarly.

In all of the grades below the ninth there is a peak for spelling in which the work is distinctly superior to the work in reading. In each case below the ninth also the work is noticeably better in computation in arithmetic than in reasoning. This is probably due to the linguistic handicap in reading and comprehending the verbal problems of the reasoning test. The profiles for the ninth and tenth grades are quite irregular, due in part at least to the small number of cases at those levels.

Perhaps the most significant information is obtained in terms of grade deficiency in each subject. Thus in the eighth grade the score of 82 in paragraph meaning corresponds to an average performance for grade 7.0. It was made by children, however, who were in grade 8.4. They were, therefore, deficient 1.4 grades in this test. A detailed analysis from this standpoint of deficiency at each grade level for each subject will be presented for the three races in the following paragraphs.

Achievement in Reading.—Figure VI summarizes the educational achievement in reading for the three racial groups at each grade level in terms of grade deficiency, the data having been taken from the educational profiles in the manner just described.

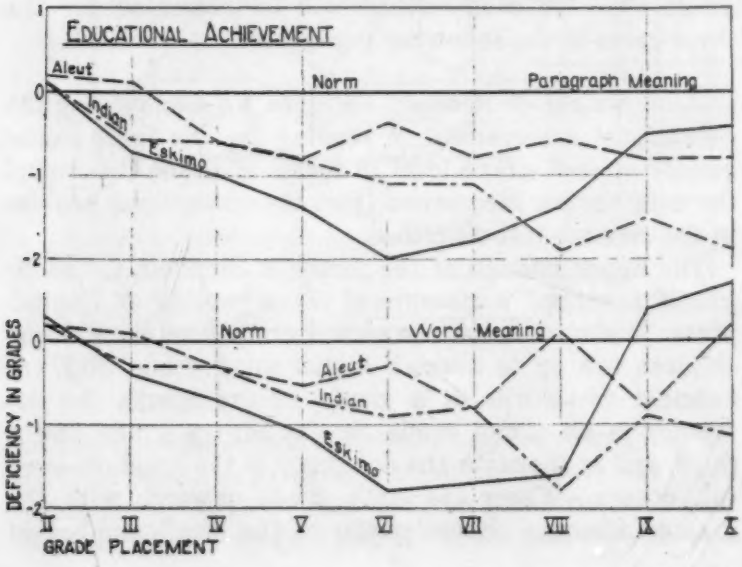
The upper portion of the figure is for Test 1, "Paragraph meaning," a measure of silent reading of English prose. It shows that at the second grade level the Eskimo children are up to normal, at the third grade they are deficient two-thirds of a grade, at the fourth the deficiency is an entire grade, at the fifth a grade and a third, and at the sixth the deficiency is the greatest—two full grades. From the sixth grade onward, with the greater selection characteristic of the small number of

children who reach the higher grade levels, the situation improves. Even the very few who reach the tenth grade, however, are still deficient almost a half grade. In general, it may be said that in comprehension of paragraph meaning the Eskimo children are deficient from one to two grades. The Indians and Aleuts make a somewhat better showing, the Aleuts being distinctly superior especially in the later grades. None of them, however, above the third grade, reach the American standard.

In the lower half of Figure VI, showing knowledge of the meanings of individual words, the situation is somewhat similar. The Eskimo show the same deep dip to a deficiency of almost two grades at the sixth grade, but rise distinctly above the white standard of performance in the ninth and tenth grades. Indians and Aleuts average about a half grade deficiency, the Aleuts again being

FIGURE VI

Average Educational Achievement of Eskimo, Aleut, and Indian Children in Paragraph Meaning and Word Meaning as Measured by the New Stanford Achievement Test



somewhat superior to the Indians and rising above the white norms in the eighth and tenth grades. For the ninth and tenth grades in all of these comparisons the small number of cases involved, as shown in Figure X, should be kept in mind.

Achievement in Spelling.—Relative achievement in spelling English words is shown in the upper diagram of Figure VII. In this subject is found the closest approach to the white norms of any of the subtests. The Aleuts are within one-third of a grade of the norm at each grade level, and slightly superior to it at the beginning and end. The Eskimo show a deficiency of almost three-fourths of a grade at intermediate grade levels but are superior at the beginning and end. Only the Indians show a constantly increasing deficiency with successive grades.

Achievement in Language Usage.—(Figure VII). The Eskimo have the same characteristic dip to a deficiency of two full grades, but superiority for those surviving to the higher grades. The Indian graph is somewhat similar to that for the Eskimo. The Aleuts, on the other hand, make a constantly poorer showing with increase in grade level.

Achievement in English Literature.—(Figure VII). In knowledge of authors, names, and facts associated with English and American literature the three groups make almost the same showing as for language usage. The Indians, however, drop to the lowest level of any test, showing a deficiency of over two and a half grades at the ninth grade level.

Achievement in History, Geography, and Physiology.—Achievement in history, geography, and physiology is shown for the three races in Figure VIII. In these subjects the Aleuts come closest to the norm, surpassing the performance of white children in several cases. The Es-

kimo show the same dip to inferiority of one and a half to two grades at the sixth grade level. The Indians show generally increasing deficiency with increase in grade level.

FIGURE VII

Average Educational Achievement of Eskimo, Aleut, and Indian Children in Spelling, Language Usage, and English Literature, as Measured by the New Stanford Achievement Test

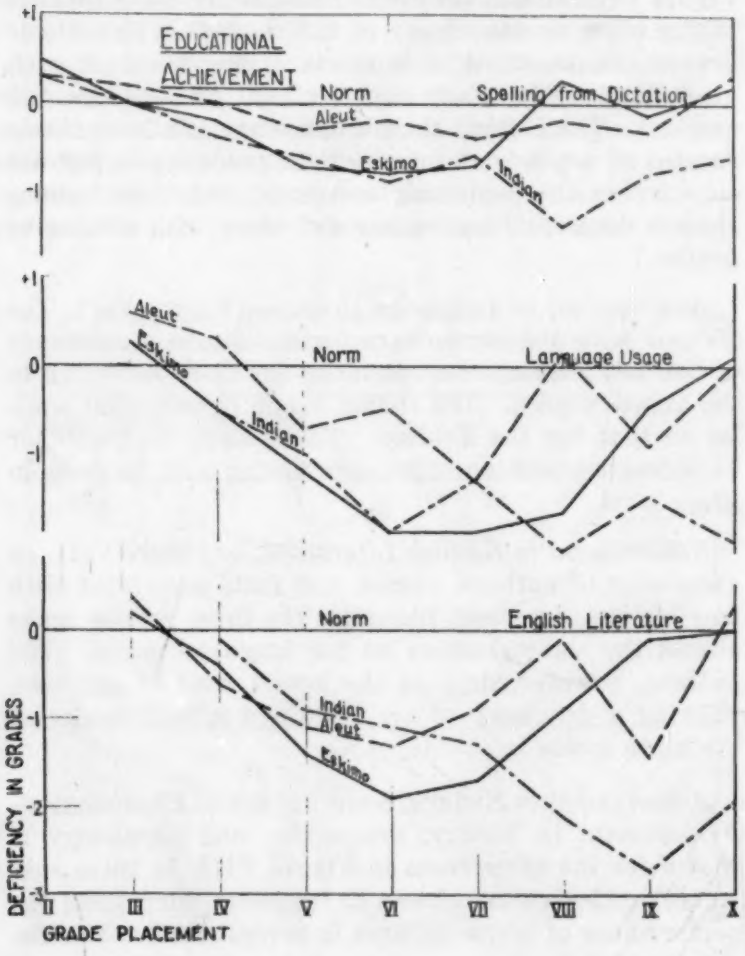
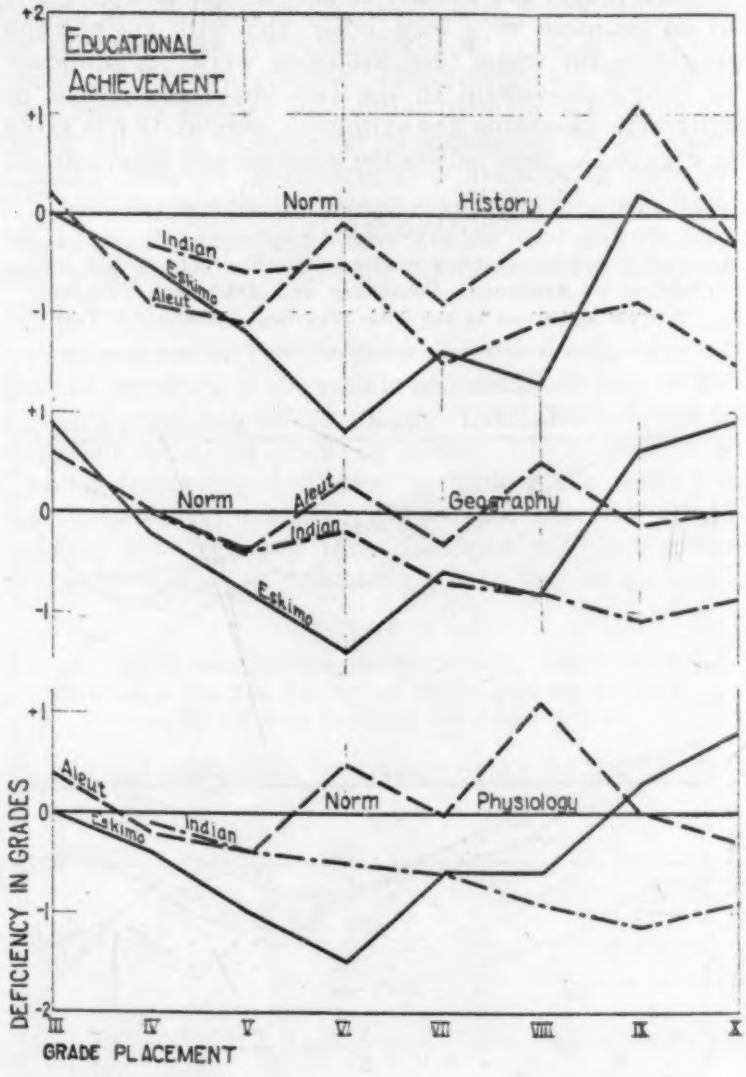


FIGURE VIII

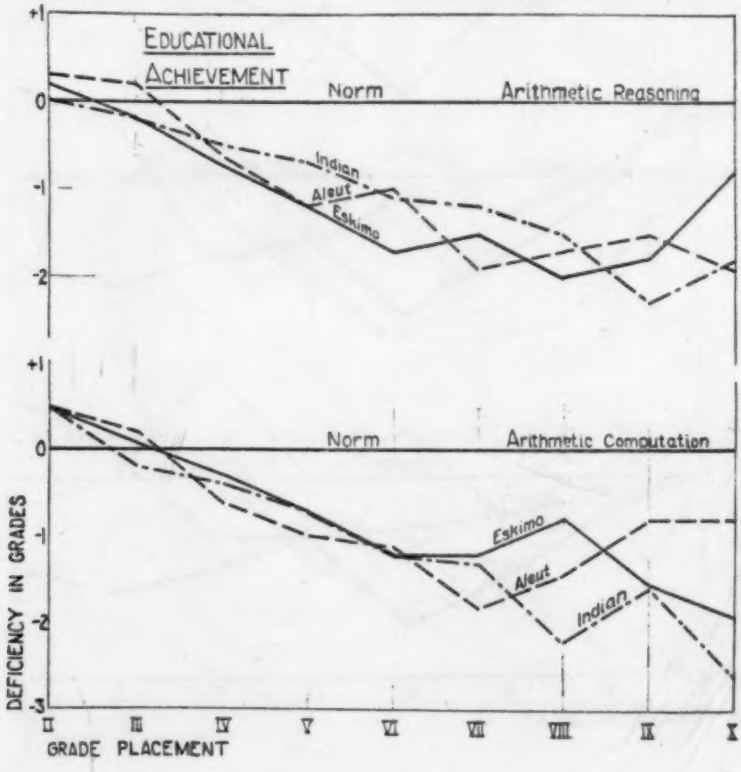
Average Educational Achievement of Eskimo, Aleut, and Indian Children in History, Geography, and Physiology, as Measured by the New Stanford Achievement Test



Achievement in Arithmetic.—A mastery of simple arithmetic is especially important for the native youth of Alaska if they are not to be made the victims of sharp traders, if they are to learn to keep simple accounts, and to do business with each other and with their white neighbors for whom they will often work. A summary of their achievement in the two important phases of arithmetic reasoning and arithmetic computation is given in Figure IX. Here, unlike the other subject diagrams, all

FIGURE IX

Average Educational Achievement of Eskimo, Aleut, and Indian Children in Arithmetic Reasoning and Arithmetic Computation, as Measured by the New Stanford Achievement Test

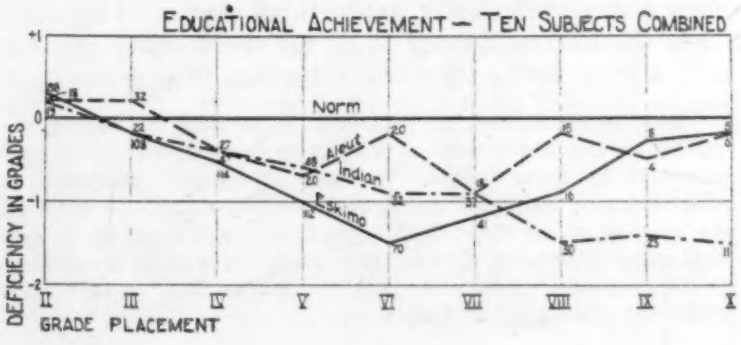


three races show a constantly downward tendency. The dip and recovery, so characteristic of the Eskimo group in all the previous tests, is only slightly in evidence in the reasoning test and entirely absent in computation. For the intermediate grades the deficiency is a full grade for all three races, while for the upper grade levels it becomes almost two grades. The graphs for reasoning show slightly greater deficiencies than those for computation, as might be expected on account of the language difficulty involved in reading and interpreting some of the problems, but the difference is not a serious one. Both sets of graphs show essentially distinct and unfortunate deficiency in simple arithmetic achievement for all three races.

Achievement in Ten Subjects Combined.—By way of general summary of the results secured by the use of the New Stanford Achievement Test, Figure X shows grade deficiency for all ten grades combined. The Eskimo show steadily increasing deficiency in each grade until the sixth where they reach a deficiency of one and a half grades; this deficiency then decreases with successive grades until for the five pupils left to test in the tenth

FIGURE X

Average Educational Achievement of Eskimo, Aleut, and Indian Children in the Ten Subjects of the Curriculum, as Measured by the New Stanford Achievement Test



grade it is less than a quarter of a grade. The Indians show the same type of dip and recovery as the Eskimo, but the deficiency is not so marked, not quite reaching one full grade at the sixth and seventh grade levels. The Aleuts show a general tendency to increase the amount of deficiency with successive grade levels until it becomes one and a half grades with the most advanced pupils.

In connection with this entire study of grade deficiency for the different races as measured by the New Stanford Achievement Test, it should be remembered that it has taken those children an average of one and a half to two and a half years of school work per grade to reach the school grade at which they were tested. A more striking failure to accomplish the work of the curriculum as planned in the time outlined could scarcely be found.

C. Measurement of Achievement in Handwriting

Samples were secured, under standard conditions, of the handwriting of over four hundred native pupils at different grade levels, although unfortunately the number of Aleuts was too small for reliable comparisons. They were evaluated by means of the Ayres Handwriting Scale, Gettysburg Edition.[3]

Quality of Handwriting.—A general summary of results of the measurement of quality, in comparison with the Ayres' norms, is given in Figure XI. The Eskimo show distinct inferiority, amounting to one or two grades. Thus the Eskimo quality of 52 for the seventh grade is only a little better than white average fifth grade qual-

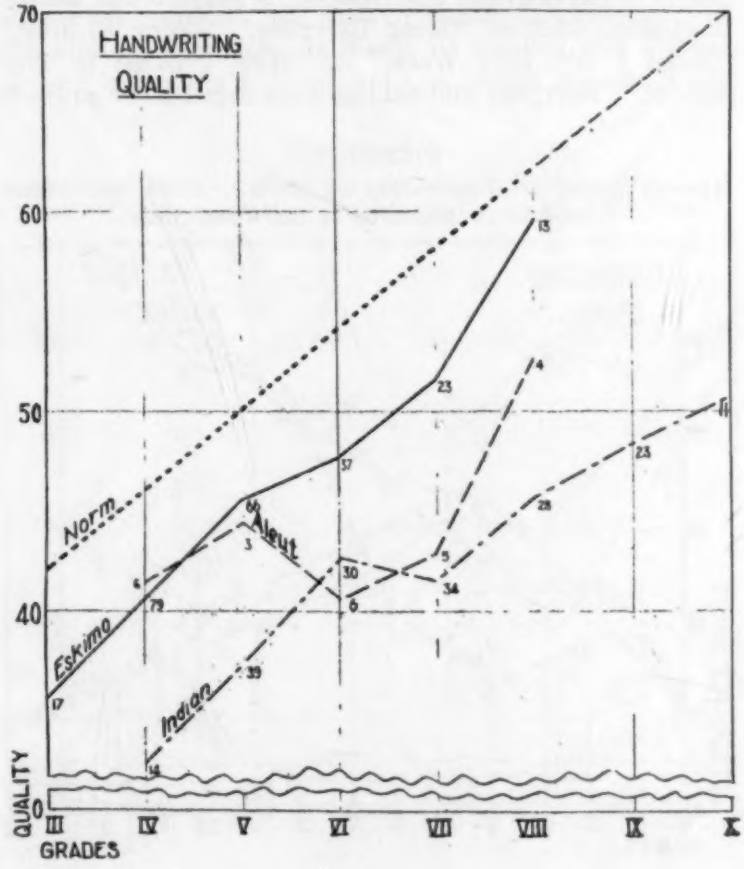
[3] Since some element of judgment is involved in scoring for quality on the Ayres Scale, the samples were all evaluated independently by three judges. In cases of marked differences in judgment, they conferred and re-evaluated the samples in question. An average of the three final ratings was used when there were final minor differences. Preliminary practice was given the children to insure general familiarity with the matter later to be written under the prescribed conditions.

ity; fifth grade work is not quite as good as average white fourth grade work. The work of the Indians and Aleuts is even more markedly deficient. These can hardly be considered satisfactory levels of achievement for practical use.

Speed of Handwriting.—In the matter of speed of handwriting, however, the situation is quite different, as

FIGURE XI

Average Quality of Handwriting of Eskimo, Aleut, and Indian Children, as Measured on the Ayres Scale



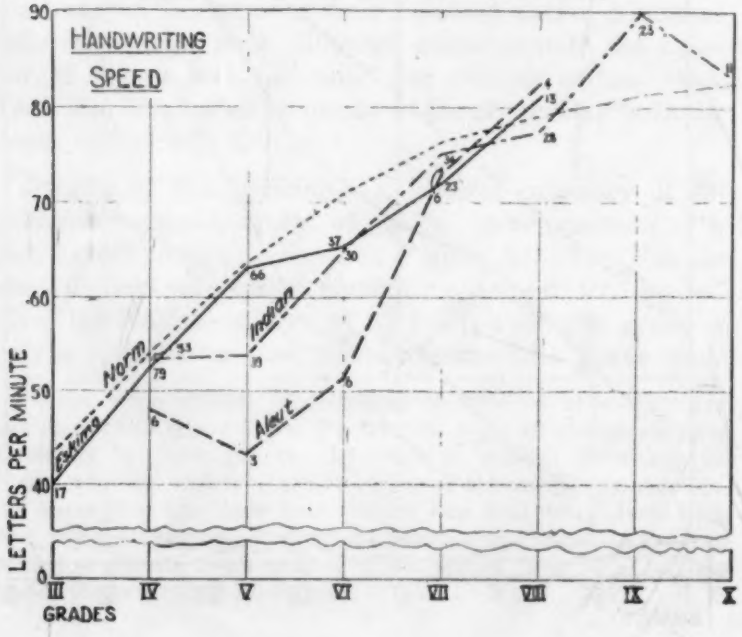
exhibited in Figure XII. The Eskimo and Indians follow moderately close to the norm at all grade levels. Only the Aleuts show marked deficiency in the matter of speed, and the number of cases is too few for conclusive judgment.

D. Measurement of Ability in English Composition

In order to secure some evidence of originality of expression and ability to write ordinary English prose, the pupils in many of the schools were asked to write short pieces of narrative or description. A subject was usually suggested, such as "Going Berrying," "Going Fishing," "What I Did Last Week," or "How I Came to This School." Berrying and fishing were found to be subjects

FIGURE XII

Average Speed of Handwriting of Eskimo, Aleut, and Indian Children as Measured on the Ayres Scale



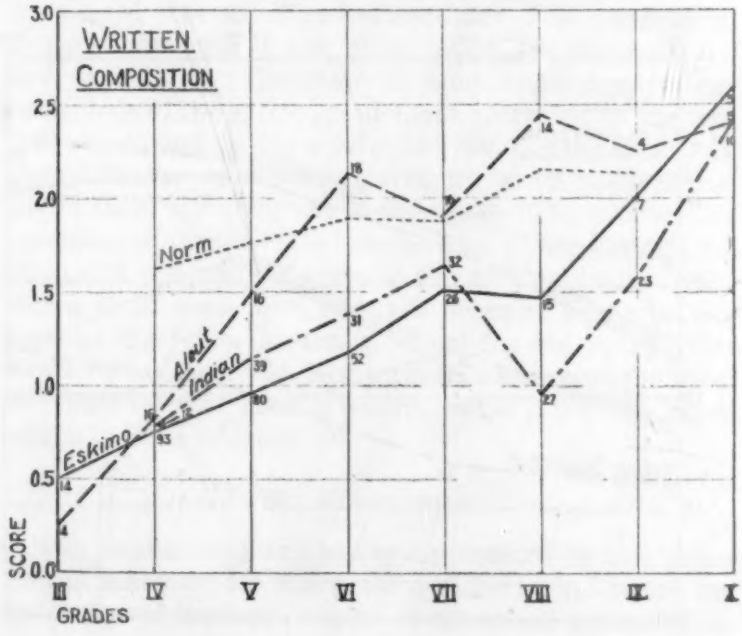
universally familiar to all children tested. In the Eskimo country reindeer work also was universally known. These subjects were used fully 90 per cent of the time.

All of the compositions were read independently by three teachers of English in San Jose State Teachers' College, California, and evaluated by the Driggs-Mayhew National Scales for Measuring Composition. The average of the three ratings was used as the final score. A summary of the results is shown in Figure XIII.

The Aleuts in several grades were evaluated as somewhat above the norm. The Eskimo and Indians were somewhat inferior, but showed steady improvement in the successive grades. It should be recalled that a large proportion of the Eskimo were in village schools, while

FIGURE XIII

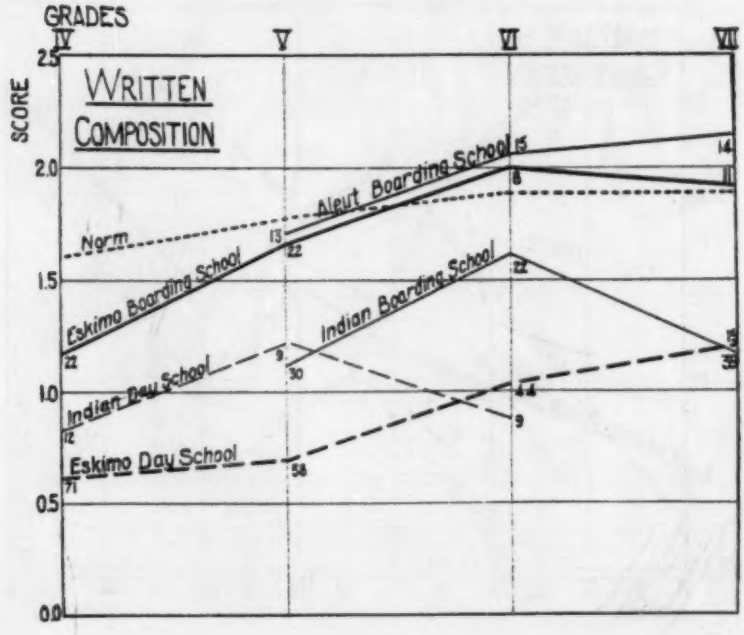
Average Ability in English Composition of Eskimo, Aleut, and Indian Children as Measured on the Driggs-Mayhew Scale



a large proportion of Indians and Aleuts were in boarding schools where the English language was in constant use not only in the classroom but also at meals, on the playground, and in every type of activity. This ought to make a material difference in power of self expression in written English. In order to test this factor, the examples of English Composition for the fourth, fifth, sixth, and seventh grades were classified on the basis of boarding school and day school. Results are shown in Figure XIV. This indicates that the Eskimo and Aleuts in the industrial boarding schools wrote as well or better than white children in the same grades. There were not sufficient Aleuts in day schools for separate classification,

FIGURE XIV

Comparison in Ability in English Composition of Eskimo, Aleut, and Indian Children Educated in Day Schools and in Boarding Schools



but the larger groups of Eskimo in day schools showed marked inferiority as might be expected. These account for the comparatively poor showing of the Eskimo in Figure XIII. On the other hand the Indian pupils in boarding schools, while somewhat superior to those in day schools, do not nearly reach the standard of the Eskimo and Aleut boarding school pupils.

E. Measurement of Musical Achievement

In the two government industrial schools at White Mountain and Eklutna and in the Sheldon Jackson (missionary) school an effort was made to measure musical achievement, although sufficient information was not secured to evaluate the results completely. Testing was necessarily limited to those native children who had been given considerable training in vocal music, hence only a small number of tests were given. The measuring instrument used was the Kwalwasser-Ruch Test of Musical Accomplishment. It was given to 29 Eskimo, 9 Aleuts, and 48 Indians. The most striking single fact is that two-thirds of the entire group made scores below the ten-percentile point on the established scale of norms. Only six pupils were above the median for white children and five of these were only slightly above it. The outstanding exception of considerable interest was a pure-blooded Eskimo girl who made a score at the 88th-percentile. She was a sixth grade girl, nineteen years of age, who had been at the White Mountain school for ten years. Her Binet IQ was only 74. Her percentile scores on the three Seashore tests of musical ability were: pitch, 75; intensity, 97; tonal memory, 40.

F. Conclusion

The implications of the facts presented in this paper and of many others which were gathered but which are not reported here, are clear. If the school system is de-

signed essentially for the ability shown by the average American child, then progress of Eskimo children must necessarily be slow and unsatisfactory. The entire test program, both of fundamental abilities as reported in the writer's earlier papers, and of achievement as summarized in the present article, offers convincing evidence that the present curriculum is not at all satisfactorily adjusted to the capacity of the natives. It shows that the present program is decidedly wasteful of the time of the pupils, of the money of the government, and of the efforts of the teachers. Extensive recommendations have been made for the revision of the curriculum, but this is not the place to report these recommendations in detail. They suggest that an indigenous curriculum should be worked out, adapted to the measured levels of ability of the children, based upon native needs, and directed toward the cultural assimilation and economic independence of the native people of the vast Territory of Alaska.

PREDICTING SUCCESS IN SIGHT-SINGING

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Colorado State Teachers College

Sight-singing, or solfeggio, is generally recognized as the one subject taught in the music conservatory which is uniquely a musical subject, success in which indicates the possession of a broad musical aptitude. For this reason the present study uses this subject as a criterion and seeks to show the bearing of certain factors on success in the musical field.

To this end data were collected from thirty-nine music students enrolled in a regular class in sight-singing under Mr. E. E. Mohr, Assistant Professor of Public School Music at Colorado State Teachers College. These data included scores obtained on five of the Seashore Musical Talent Tests, those of Tonal Memory, Rhythm, Time, Intensity, and Pitch. The scores used for this study were the totals for all five tests combined. Each student on entering Colorado State Teachers College is required to take certain entrance tests, including the two used herein, namely, the Teachers College Achievement Test and the American Council Psychological Examination, sometimes known as the Thurstone Intelligence Test. Raw scores on all these tests were used in order to obtain more accurate correlations.

The zero order correlations between these various variables are comparatively high, especially that between the scores on the Seashore tests and sight-singing scores, namely, .75 (Table I). Probably one reason for this high coefficient is the fact that the scores for sight-singing were based on a very objective performance test in use by Mr. Mohr and constructed by him. The

correlation between the Seashore measures and intelligence, .38, is perhaps also slightly higher than that usually obtained.

TABLE I

Zero Order Correlations, with Means and Sigmas of Variables, Based on Data Obtained from 39 Music Students at Colorado State Teachers College, Greeley, Colorado, Winter Quarter, 1932

	1	2	3	4 (a)
1	2	3	4	5
(a) 1		.75	.56	.64
2			.40	.38
3				.68
Means	91.20	343.10	319.60	126.08
Sigmas	17.80	17.70	67.80	44.64

(a) Variables
1. Sight-singing Test Scores
2. Seashore Musical Talent Test Scores
3. Teachers College Achievement Test Scores
4. American Council Psychological Examination Scores

Although the technique of the path coefficient is somewhat new to the literature, it furnishes an excellent method of determining the relative influence of various factors on a criterion. With this in mind it will be seen that the order of importance of the three variables used herein is, first, Seashore Tests; second, intelligence, and third, knowledge of ordinary school subjects, such as English, History, and Arithmetic, as measured by the Teachers College Achievement Test (Table II).

These path coefficients are the regression equation coefficients with the sigmas equal to one, so to obtain the regression equation coefficients in score form it is necessary only to multiply each path coefficient by the ratio of the sigma of its variable to the sigma of the

TABLE II

Path Coefficients and Coefficients of Determination Based on Data Obtained from 39 Music Students at Colorado State Teachers College, Greeley, Colorado, Winter Quarter, 1932

		Paths	Coefficients
	1	2	3
(a)	$p_{1.2}$	a	.58
	$p_{1.3}$	b	.08
	$p_{1.4}$	c	.37
	$d_{1.2}$	a^2	.3364
	$d_{1.3}$	b^2	.0064
	$d_{1.4}$	c^2	.1369
	$d_{1.23}$	$2abr_{23}$	.0371
	$d_{1.24}$	$2acr_{24}$	.1631
	$d_{1.34}$	$2bcr_{34}$	.0403
			.7202
	$d_{1.x}$	g^2	.2798
			1.0000

(a) Variables
1. Sight-singing Test Scores
2. Seashore Musical Talent Test Scores
3. Teachers College Achievement Test Scores
4. American Council Psychological Examination Scores

criterion. Following this procedure the regression equation becomes:

$$X_1 = .59X_2 + .02X3 + .15X_4 - 146.53$$

To obtain the most probable score on the sight-singing examination it is necessary only to multiply the total score obtained on the five Seashore tests by .59, multiply the raw score obtained on the Achievement Test by .02, multiply the raw score obtained on the American Council Psychological Examination by .15, add these results together and subtract 146.53.

The most definite way of ascertaining the relative and total influence measured by any set of variables is by

means of coefficients of determination. The direct influence of a variable on a criterion is indicated by the square of the path coefficient connecting the two. Thus by referring to Table II it will be seen that the Seashore measures account for over one-third of the sight-singing scores, intelligence for about fourteen per cent, and the knowledge represented by the Achievement Test only two-thirds of one per cent. The joint influence of these factors is obtained by doubling the product of their two paths multiplied by the correlation coefficient between the two independent variables. If these be apportioned to each variable in the proportion of their direct influences the Seashore measures account for about 50 per cent of the scores in sight-singing, the intelligence test for about 20 per cent and the achievement test for only about 2 per cent. This leaves only 28 per cent to be accounted for by such other unmeasured factors as previous training, motor ability, and opportunity for musical contacts.

By comparing these final results with the original zero order correlations, it will be seen that it is not sufficient to consider only these correlations when seeking to determine the relative or total influence of various factors on a dependent variable. The multiple correlation obtained in this study was .84, which is sufficiently high to insure reliable results with the regression equation. The PE estimate of the regression equation is 7.48 so that the chances are even that the obtained sight-singing score will fall within 7.48 of the predicted score. When it is considered that there is a total possible range of about 150 points on Mr. Mohr's test, this PE estimate is rather small.

In conclusion it may be said that, in determining probable success in music, musical talent tests are about two and one-half times as indicative as intelligence tests, and twenty-five times as effective as tests of general knowledge of school subjects.

JEWISH MUSICALITY IN AMERICA*

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A "racial" phenomenon of general interest is the reputed fact of Jewish distinction in the music of our day. Jewish frequency is commonly noted among the virtuosi, with interpretations ranging from the astute to the mystical. This investigation was projected in the effort to document Jewish musicality and to interpret the findings experimentally.

PROSPECTUS

Two sets of data are examined: (1) the evidence for Jewish achievement in current American music, and (2) test results on the musical talent of Jewish and non-Jewish children. Pronounced Jewish productivity in several musical *genres* and equal performance by Jewish and non-Jewish children on tests of so-called musical aptitude, are the quantitative findings of the study. The results will be presented in this order: I. The data on musical attainment of Jewish adults; II. The results on child-measurements; III. An interpretative section.

I. JEWISH ACHIEVEMENT IN CONTEMPORARY MUSIC

Superiority perennially resists definition. As far as possible, labelling is not indulged in the present study. The standards of musical accomplishment are admittedly makeshift. Each criterion will be defined before presenting the actual results.

* The study was subsidized by a grant-in-aid from the Social Science Research Council.

Standards for Selecting Adult Musicians.

(1) So-called *virtuosi* are selected on the basis of solo-performance with the four American orchestras which are generally accepted by critics as the foremost symphonic societies in the United States: The Boston Orchestra, The Chicago Orchestra, The New York Philharmonic Orchestra, and The Philadelphia Orchestra. This category covers a span of 13 seasons, from 1920-21 to 1932-33 inclusive. The criterion assumes that conductors and managements select guest-artists objectively. Quite arbitrarily the nominations are restricted to male instrumentalists. The list is certainly not all-inclusive.

(2) A larger group of *instrumentalists* is drawn from the permanent personnel (season of 1932-33) of 12 American symphony orchestras. Eleven of the orchestras are associated with musical societies in large cities of the country: Boston, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, Minneapolis, New York (The New York Philharmonic Orchestra), Philadelphia, St. Louis, and San Francisco. The RKO Symphony Orchestra at Radio City is added to the list. Women players are eliminated because of their infrequency. Certain instrumentalists are excluded due either to infrequent mention in the personnel or to "doubling," *i. e.*, where a player is assigned to two or more sections of the orchestra. The excluded categories are organ, harp, piano, saxophone, and banjo.

(3) The orchestra *conductors* are the permanent maestros (season of 1932-33) of the 12 symphonic groups just enumerated, and the guest-conductors (1920-21 to 1932-33) of the four orchestras which are used to identify the virtuosi.

(4) A list of *instrumentalists* in the *amusement field* is compiled from the personnel of 23 popular orchestras. Thirty groups were identified originally on the basis of national broadcasts. The list was then submitted to two

radio editors for amendment. These groups are affiliated with radio, hotel, and theater music. They are centered largely in New York City. A slight majority of the leaders or conductors are non-Jewish. The criterion is offered without evaluation as music.[1]

(5) The major criterion of *composition* is the volume, *American Composers,* compiled by Claire Reis and published by the United States Section of the International Society for Contemporary Music (34).[2] A supplementary list was submitted by Dr. Charles N. Boyd, co-editor of the American Supplement of *Grove's Dictionary* (18). The two lists (Boyd, N = 18; Reis, N = 127) were combined. Neither source may be utterly uninfluenced by a standard of inclusion which is directly involved in the present study.

(6) A further nomination of contemporary composers includes the composer-artists who have appeared with the Boston, Chicago, New York Philharmonic, or Philadelphia orchestras between 1920-21 and 1932-33. This list overlaps the Reis-Boyd group to the extent of 50 per cent of the former; and it can hardly be labelled American, either by nativity or by residence.[3]

[1] For the data on this group, acknowledgment is made to Messrs. Leon Belasco, Ben Bernie, Fred Berrens, Don Bestor, Nat Brusiloff, Eddie Davis, Meyer Davis, Al Goodman, Ferde Grofé, Wayne King, Andrée Kostelanetz, Guy Lombardo, Vincent Lopez, Bert Lown, George Olsen, Arthur Pryor, B. A. Rolfe, Dave Rubinoff, Sam Robbins, Harry Salter, Harold Stern, Rudy Vallée, and Paul Whiteman.

[2] The Society considered important composition which met a number of requirements: the larger forms, primarily inspired in the American environment, written by American-born musicians or by American residents, and produced between 1912 and 1932. (34, ii.)

[3] The same point holds for guest-conductors and -artists, many of whom are only occasional visitors to the United States. For example, Wilhelm Bachaus, Pablo Casals, Walter Gieseking, Serge Prokofieff, Richard Straus, Igor Stravinsky, *et al.*

These various categories are not equivalent or homogeneous or representative of all competent musical effort in the western world. They do seem sufficiently valid to afford an approximate index of Jewish attainment in contemporary American music. Occasional misplacements are very probable, *e. g.*, where a versatile musician is listed in two or more *generes* and his *forte* is clearly restricted, or where a musician should not be listed at all by more stringent standards.

Identification of Jewish Musicians.

Jewishness, as a working concept for this study, is perhaps the cultural fact of being accepted by other Jews as Jewish. In view of statistics on inter-marriage (9, pp. 304-5; 17, pp. 196-7; 19, p. 83), an unknown fraction whom I treat as Jewish by one or another criterion are of mixed origin. In several cases, this point is documented accurately. These few (known) cases are arbitrarily classified as Jewish. To the extent that Jewish stock is diluted by race-crossing, the phenomenon under consideration ceases to exist as a matter of possible Jewish inheritance. Psychically the infusion of non-Jewish blood is probably insignificant in many communities, unless the admixture is very remote, because of the peculiar Nordic-Caucasian practice to which Jews are subjected, namely, the all-or-none distinction.[4]

Jewish-identification of symphonic and amusement players was relegated to the managements of the respective orchestras. This procedure involved correspondence

[4] Race as culture concept is gradually displacing the notion of race as biological (endowment) concept, at least, between European nationalities and apparently as between European Jew and non-Jew. (6, Ch. 2, 4; 19, pp. 46, 83-4.) It is interesting to note that in recent litigation before the Supreme Court of Hungary, the court ruled that "Jews constitute a religious community, and not a race." (32, p. 127.) In the section on Jewish children I employ a convenient, but no more reliable, criterion of Jewishness, *viz.*, attendance at a Hebrew school!

with each conductor. The instructions prescribed: (1) an impersonal tabulation on every section of the orchestra, specifying the total number of players and the number of Jewish players; (2) reliability of rating by assigning the task to an orchestra member of long standing; (3) a working definition of Jewishness; (4) conservative judgment, in considering doubtful cases non-Jewish; and (5) designating all cases known to be mixed Jews. The symphonic reports were submitted by the personal managers or by other qualified individuals whom the conductors recommended. With amusement orchestras the majority of replies were submitted by the leaders who were further requested to report each versatile player according to his *forte*.

The reliability of Jewish-identification is open to question, particularly in a symphonic organization with a large roster. As a check, the entire personnel of the Boston and Philadelphia orchestras was circularized with a brief personal letter, a mimeographed prospectus, and a questionnaire on nativity and "racial" extraction of the grand-parents. The membership of the two orchestras is 213 players. One hundred and fifty-six players replied. The managements, which had provided a check-list, made three errors, assuming the accuracy of the self-reports. Two self-designated non-Jews had been labelled as Jewish. One self-identified Jew had been classified as non-Jewish. This agreement may not hold for the generality of orchestras.

Jewish conductors, composers, and virtuosi were identified by means of Gdal Saleski's manual, *Famous Musicians of a Wandering Race* (36). The reliability of this volume is largely a matter of internal evidence. The points favoring reliability are summarized in a footnote.[5]

[5] Saleski professes as his source of data, "direct contact with the person" involved, or "first-hand information from members of the family or associating artists." (*Supra*, vii.) The volume contains an immense amount of personal documentation not avail-

To isolate other Jewish musicians and to check Saleski's source-book, a mimeographed list of the musicians in question was submitted to 18 well known musicians and critics reputed to have wide personal connections in the musical world. The judges were asked to attempt provisional Jewish-identification and to document any placement of Jewishness or non-Jewishness. First, the judges confirmed most of Saleski's identifications by consistent agreement, and in no instance was Saleski reversed by definite documentation. Second, the voting process was used *solely* as a drag-net for detecting possible Jewish origin in cases not included by Saleski. Personal correspondence with the "probable" Jewish musicians followed. If no reply or confirming acknowledgment was received, a given musician was considered non-Jewish.

It should be stressed that three tabulations—those for conductors, composers, and virtuosi—are understatements of Jewish incidence. These ratios are minima.

The Results on Adult Jewish Musicality.

(1) Jewish incidence among symphonic instrumentalists is summarized in Table I. The range of Jewish personnel in individual orchestras is from seven to 46 per cent with a median of 23.9 per cent.

able in other dictionaries, a large number of quoted self-acknowledgments (as to Jewishness), and a considerable number of photographs with autographed references to the author. By the nature of the volume, it is unlikely that identifications were made unreliably or without the consent of the (living) subjects. Certain musicians known to the writer were petitioned by Saleski for permission to have their biographies published. If this technique was general, inclusion by Saleski is probably indicative of Jewishness. Five violinists, two conductors, and two composers, who were listed by Saleski, acknowledged Jewish extraction in correspondence with the present writer. See supplementary evidence in confirmation of Saleski.

TABLE I

Distribution of Jewish Musicians in Twelve Symphony Orchestras of the United States*

Section	Total Players	Jewish Players	Percent Jewish Players	
Strings				
First violin	180	92	51.1	
Second violin	155	53	34.2	
Viola	120	39	32.5	34.0%
Violoncello	111	28	25.2	
Bass	98	14	14.3	
Woodwinds				
Oboe	40	5	12.5	
Bassoon	42	5	11.9	
Clarinet	45	4	8.9	9.6%
Flute	40	2	5.0	
Brass				
Trumpet	48	8	16.7	
Trombone	44	4	9.1	
Tuba	13	1	7.7	9.4%
Horn	66	3	4.5	
Percussion	46	11	23.9	
Total	1048	269	25.7	

Here and in other tabulations stringed instruments are the Jewish *forte*. One-third of the string section and one-half of the first violin players are reported as Jewish. Two non-string sections are fairly striking in Jewish personnel: percussion and trumpet. In spite of Jewish infrequency on woodwind and brass, total Jewish incidence among the thousand musicians is upwards of one-fourth.

Reports on three European orchestras[6] indicate an extremely low ratio of Jewish players, between zero and

* The societies of Boston, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, Minneapolis, New York (the New York Philharmonic Orchestra), Philadelphia, St. Louis, and San Francisco, and the RKO Symphony Orchestra at Radio City.

[6] Société des Concerts du Conservatoire, Paris; British Broadcasting Co. Symphony Orchestra, London; Staats Theater Orchester, Munich, January, 1933.

five per cent. The national differences, if established, arise from the western migration of Jewish talent and from internal conditions of the respective countries.

(2) About half of the maestros of our larger orchestras are Jewish. It was noted earlier that many of the guest-conductors are permanent residents of Europe.

TABLE II

Jewish Incidence Among the Permanent Maestros of Twelve American Orchestras (season of 1932-33), and the Guest Conductors of the Boston, Chicago, New York Philharmonic, and Philadelphia Orchestras, from 1920-21 to 1932-33†*

All Conductors	Jewish Conductors	Per cent Jewish Conductors
37	17	45.9

* See Table 1.

† See Appendix A for a list of the conductors.

(3) At least one-half of the concert violinists, and one-third of the piano-virtuosi, are of Jewish derivation. By more select standards some of the instrumentalists reported in Table III might not qualify as master-performers.[7]

TABLE III

*Jewish Incidence Among Concert Artists, 1920-21 to 1932-33**

	All Artists	Jewish Artists	Per Cent Jewish Artists
Violinists†	59	28	47.5
Pianists	65	23	35.4
Violoncellists	21	3	14.3
Total	145	54	37.2

* Instrumental soloists who appeared with the Boston, Chicago, New York Philharmonic, or Philadelphia orchestras. See Appendix B.

† Seven viola players included.

[7] Tentative distinctions within this group are made in a later section.

One estimate of Jewish incidence is made for women artists of high standing, the criterion here being solo-appearance with the New York Philharmonic Orchestra during 13 seasons, 1920-21 to 1932-33. Five of 16 women pianists, and three of eight women violinists, are of Jewish origin.[8]

(4) In composition Jews are relatively less numerous, at least in the larger sample of composers.[9]

The discrepancy between the two indices—which are not altogether independent—is due superficially to the

TABLE IV

Jewish Ratio Among So-Called American Composers

	All Composers	Jewish Composers	Per Cent Jewish Composers
Reis-Boyd standard*	145	21	14.5
Orchestra appearance†	42‡	10	23.8

* Claire Reis, *American Composers*, 1932. (34) See Appendix D for supplementary Boyd list.

† Composer-artists who appeared with the Boston, Chicago, New York Philharmonic, or Philadelphia orchestras, 1920-21 to 1932-33. See Appendix E.

‡ Nineteen of whom appear in the Reis-Boyd group.

[8] Saleski, *op cit.*, was consulted for Jewish-identification. A list of the artists is found in Appendix C.

[9] The popular interpretation of this point is very questionable. Plausible reasons for the seeming paradox that productivity in general composition is less common than instrumental success among Jews, are the difficulty of economic survival as composer —and as Jew—plus the historic dependence of composers on church and patronage, the relative exclusion of Jews from the Renaissance and from vigorous national movements, and the fact that modern composition is too embryonic to permit even preliminary racial demarcations. A dozen intelligent musicians, Jewish and non-Jewish, have stated that Jews have "high interpretative ability but little creative talent in music." The classic process of restating description as explanation! At least the alternative theory does not extend to medicine, physics, philosophy, and the like, and its validity is hardly established in music.

Reis-Boyd criterion of American birth or American residence.

(5) Obviously, all symphonists and concert-artists are not gifted or skilled equally. A refinement is next attempted by way of distinguishing between instrumentalists on an "ability" basis. In Table V, Jewish personnel is related to the reputed caliber of various symphonic ensembles. The eleven metropolitan orchestras[10] were ranked for general superiority by four judges: Dr. Charles Boyd, Dr. Harvey Gaul, and Messrs. Ralph Lewando and Fred Lissfelt. The latter three are music critics for the leading daily newspapers of Pittsburgh. The median inter-correlation of judgments (method of rank-differences) was .90±.04; the range of values from this point, ±3. The rankings were averaged for the *r*'s of Table V.

TABLE V

*Correlation Between (1) the Excellence of Orchestras, and (2) Their Ratio of Jewish Players**

Excellence of orchestra with:	*r* PE,
Per cent Jewish personnel, total orchestra	.41±.19
Per cent Jewish personnel, percussion	.42±.18
Per cent Jewish personnel, brass	.38±.19
Per cent Jewish personnel, first and second violins	.36±.19
Per cent Jewish personnel, first violin	.36±.19
Per cent Jewish personnel, second violin	.35±.20
Per cent Jewish personnel, viola	.32±.20
Per cent Jewish personnel, all strings	.22±.21
Per cent Jewish personnel, violoncello	.11±.22
Per cent Jewish personnel, woodwind	.10±.22
Per cent Jewish personnel, bass	−.02±.22

* See text for details of construction. *r*'s computed by the Spearman rank-differences formula.

A number of questions are begged by the foregoing data, *e. g.*, the distribution of Jews in the general population of the centers where orchestras are found, and

[10] *Supra*, Table I.

the effect of wealth upon population movements and cultural development in these communities. The point will stand, uninterpreted, that a slight, positive, unreliable correlation exists between Jewish incidence in personnel and the ranking of American orchestras in the opinion of four critics.

Halls of fame seem particularly inapplicable to contemporary musicians. My criterion of the master-performer on violin and piano is arbitrary, namely, frequency of appearance with four American orchestras.[11]

TABLE VI

Jewish Incidence Among Master-Violinists: Solo-Artists of the Boston, Chicago, New York Philharmonic, and Philadelphia Orchestras, 1920-21 to 1932-33

A. Incidence related to *total number of performances**

Total No. of Performances	All Violinists	Jewish Violinists	Per Cent Jewish Violinists
1	26	9	34.6
2-3	13	5	38.5
4-13	20	14	70.0

B. Incidence related to *appearance with different orchestras**

No. of Orchestras with which Artist Appeared	All Violinists	Jewish Violinists	Per Cent Jewish Violinists
1	37	15	40.5
2	11	5	45.5
3-4	11	8	72.7

C. *Average number* of performances

	Mean	S.D.	N	Diff.	D/σ_D
Jewish artists	4.0	3.16	28	1.2	1.5
Non-Jewish artists	2.8	2.96	31		

* Infrequent soloists may include more Jewish players than the tabulations indicate, *i. e.*, lack of identification as Jewish is probably commoner with the less distinguished musicians. See section on Jewish-identification.

[11] In several mentionable instances the frequency criterion clearly fails to do justice to an artist. Many factors besides sheer musicianship affect the measure: age, physique, personal charm,

Among violinists (Table VI) a good majority of the more frequently heard artists are Jewish. The same statement in moderation holds for piano-virtuosi. (Table VII.) Whatever form of musical accomplishment is implied by this tabulation, Jewish musicians have more of it.

TABLE VII

Jewish Frequency Among Master-Pianists: Solo-Artists of the Boston, Chicago, New York Philharmonic, and Philadelphia Orchestras, 1920-21 to 1932-33

A. Frequency related to *total number* of performances*

Total No. of Performances	All Pianists	Jewish Pianists	Per Cent Jewish Pianists
1	22	6	27.3
2-3	18	6	33.3
4-15	25	11	44.0

B. Frequency related to *appearance* with *different orchestras.*

No. of Orchestras with which Artist Appeared	All Pianists	Jewish Pianists	Per Cent Jewish Pianists
1	29	9	31.0
2	12	4	33.3
3-4	24	10	41.7

C. *Average number* of performances

	Mean	S.D.	N	Diff.	D/σ_D
Jewish artists	4.6	4.26	23	0.09	0.88
Non-Jewish artists	3.7	3.26	42		

* See note to Table VI.

(6) Amusement music is not an exception to Jewish inclusion. The criterion need not, and probably could not, be definitely evaluated in relation to the previous musical *genres.* The orchestras in question are select

other professional duties, or the mere disinclination to travel. For Jewish violinists the correlation between age and number of appearances is +.01. (Rank differences.) For pianists, the r is +.12.

and representative within their field. The data follow in Table VIII.

TABLE VIII

Distribution of Jewish Players in 23 Amusement Orchestras in the United States

Section	All Players	Jewish Players	Per Cent Jewish Players	
Strings				
Violin	111	81	73.0	
Violoncello	14	9	64.3	
Bass	20	6	30.0	52.7%
Guitar	9	1	11.1	
Banjo	30	0	0.0	
Woodwinds				
Accordion	10	6	60.0	
Saxophone	112	28	25.0	
Clarinet	17	0	0.0	
Flute	6	2	33.3	24.5%
Bassoon	2	1	50.0	
Oboe	4	0	0.0	
Brass				
Tuba	23	6	26.1	
Trumpet	77	19	24.7	
Trombone	38	1	2.6	18.1%
Horn	6	0	0.0	
Piano	63	31	49.2	
Percussion	54	21	38.9	
Total	596	212	35.6	

Jewish proclivity toward the strings is again in strong evidence. Over half of the string section is manned by Jewish players and 73 per cent of the violin assignments. It is interesting to note the nearly total absence of Jewish personnel on banjo and guitar. It cannot be said that the strings monopolize Jewish effort. Witness the Jewish participation in brass and woodwind: accordion, saxophone,[12] tuba, and trumpet; and the large in-

[12] A prominent band leader reports that a large number of Jewish musicians, originally violinists, retrained themselves on various novelty instruments in view of an oversupply of violinists.

cidence of pianists and percussion players. Certain sections are strikingly "non-Jewish:" the clarinet, trombone, and horn. The nativity of amusement players is unchecked. American birth is probably much more frequent than among symphonists and virtuosi.

Ratio of Jewish Population to Total Population.

No single index of general Jewish population is strictly comparable to Jewish musical incidence. In relation to the total number of Jews in Europe and the United States, the ratio of Jewish musicians is tremendous, for example, with violin virtuosi, from 12 to 25 times expectancy. Compared with the density of Jews in the large American cities where symphony orchestras exist, Jewish musical incidence is significantly lower. With concert violinists, again, roughly three times expectancy. According to this standard several *genres* fall below expectancy, *e. g.*, the brass and woodwind sections. The majority of the virtuosi in this study and nearly all of the conductors are foreign-born.[13] Most of the Russo-Polish-born violinists and pianists are Jewish, yet in terms of the population of the cities bordering west and southwest Russia, Jewish virtuosi occur not more than three or four times expectancy. Kiev, Odessa, Warsaw, Lemberg, Budapest and Kharcov—prolific sources of the group in question—are one-quarter to one-half Jewish in general population. (3, pp. 227-281.) Yet, irrespective of the population norm Jewish eminence in present-day American music is beyond question. Table IX and Table X epitomize the figures on Jewish population.

[13] See Appendix F for a tabulation on the nativity of all adult musicians, including members of The Boston Orchestra and The Philadelphia Orchestra.

TABLE IX

Proportion of Jews in the General Population of the United States of America in 1927 (after Linfield, 26, Table I, VII, XIV, p. 42)

	Per cent Jews of general population	Per cent Jews of all (U.S.) Jews
48 states	3.58	
Boston, Chicago, City of New York, Philadelphia combined	20.6	57.9
Ill., Mass., N. Y. State, and Penn'a. combined	8.8	68.1
11 cities in which the 12 symphony orchestras are located	16.1	65.7
9 states in which the 12 symphony orchestras are located	6.2	80.2
Cities of 100,000 or more population	11.1	84.0
North Atlantic seaboard*	8.4	78.0

* Maine, N. H., Mass., R. I., Conn., N. Y., N. J., Pa., Md., Del., and Washington, D. C.

TABLE X

Ratio of Jews in the General Population of Europe, 1920 to 1929 (After Linfield, 3, 4)

	Per cent Jews of general population	Per cent Jews of all Jews in Europe
All countries	1.89	---
Central Europe*	6.0+	80.8
Russia, U.S.S.R.**	8.29	23.8
R.S.F.S.R.	3.13	6.0
White Russia	40.12	3.7
Ukraine	22.68	13.1
Austria	3.75	2.7
Hungary	5.54	5.1
England, France and Germany combined	0.73	11.1
Poland	9.35	30.6

* Poland, Danzig, Lithuania, Latvia, Austria, Czecho-Slovakia, Hungary, Roumania, Russia (Crimea, Ukraine, and White Russia).

** The figures are for *urbanized* Russia, from the official 1926 census. Over 80 per cent of the Russian Jews are concentrated in towns and cities, of 2500 or more population. Southwest Russia has more than 90 per cent of the total Jewish population of the U. S. S. R.

II. The Musical Talent of Jewish and Non-Jewish Children

A possible explanation of the musicalness of adult Jews is the existence of greater musical talent among the Jewish people. Such a conclusion does not naturally follow. John Dewey and L. L. Bernard have brilliantly exposed the legerdemain whereby descriptions—of racial, sex, class, or individual psychologies—are twice—introduced as explanations of habit phenomena.[14] To interpret Jewish musicality an obvious step is to compare the talent of Jewish and non-Jewish children at large.

In the selection of a test battery the literature was culled for devices which constitute the best approximation to musical aptitude. The criteria were (1) standardization and (2) ground research on nature and nurture. The battery contains three tests from the Seashore group: pitch, tonal memory, and intensity; the Kwalwasser-Dykema test of tonal movement; and Drake's test of musical memory. The background of the Seashore tests is fully documented by Farnsworth and Larson. (15, 16, 25.) Unpublished data were made available by Dr. Paul R. Farnsworth and Dr. Raleigh M. Drake on the reliability of the Kwalwasser-Dykema test. Drake's musical memory test, devised in a dissertation at the University of London, was evaluated by means of un-

[14] Professional musicians indulge this mechanism as frequently as do laymen. A well known instrumentalist states that Jews have "an inborn love of music". A conductor of international reputation writes that Jews possess "a special facility and gift of brain and finger". A noted American composer and critic attributes Jewish musicality to "a typical Oriental sharp musical sense (ear, rhythm, etc.)". As judicial a scholar as Prof. A. Z. Idelsohn concludes from his masterly study on Jewish music, that "Musical talent is undoubtedly a pronounced feature of the Jewish people." (*21*, p. 476.) A difference of terms is, of course, possible in the latter case.

published material placed at my disposal by the author.[15] The mechanics of this test are briefly described.[16]

Administration of the Tests.

Independent samples of ten- and eleven-year-old children were tested in St. Paul, Minnesota, and in Pittsburgh, Pennsylvania. The St. Paul tests were given by Miss Mathilda Heck, Director of Public School Music. Miss Heck, an accomplished musician, is an experienced tester, adequately trained in measurements. The Seashore and Kwalwasser-Dykema tests were given to natural class room groups over two sittings. Schools were chosen with a large Jewish enrollment. The children were wholly unaware of the object of the survey.

The Pittsburgh material (Drake test) was gathered by the writer. The Jewish children were tested in the

[15] Since published in the *J. Appl. Psychol.*, The Validity and Reliability of Tests of Musical Talent, August, 1933.

[16] In its present form, the Drake test is administered on the piano. It purports to measure melodic acuity in detecting changes of key, time, or note, after exposure to short, simple, original, two-bar melodies. There are 24 trials. A rest period follows the 16th trial. Testing takes about 45 minutes. Each trial has this arrangement: (1) the enunciation of an unfamiliar two-bar melody as the criterion or standard of comparison; (2) the playing of secondary melodies which are to be compared with (1), the possibilities being neither "identical", "change of key", "change of note", or "change of time". The judgments are mutually exclusive, as only one alternative fits each of the subsequent melodies in a given trial. Difficulty is progressive by the complexity of the original declaration (from trial 1 to 24) and by demands on the memory span (two secondary melodies in the first four trials, seven in the last four, etc.) In my opinion, the 24 original melodies could be better standardized for attention value. To perfect the method of presentation, I memorized the key and invited the criticism of two professional musicians. Probable changes of nuance in the course of several weeks were at least equally divided among Jewish and non-Jewish groups due to alternate testing.

Hebrew schools of the city. The non-Jewish sample was tested in five Roman Catholic schools and in branches of the Y. M. C. A. The lack of uniform motivation is a constant error favoring Jewish performance. For ten of the twelve Jewish subgroups the test-situation meant novelty and relief from Hebrew School. For six of the eleven non-Jewish subgroups the test intruded into a recreational setting.[17] In the playgrounds and Hebrew Schools, it was possible to establish some degree of rapport before the session was under way. Each test was given to a group of about 20 in number. The piano was checked in advance and in one case specially tuned. Each subgroup was motivated by a small award—a manual on symphonic music. (28.) Independent effort was controlled by seating arrangement and general technique. A proctor usually remained in the room. Jewish children showed a greater interest in the procedure owing to the situation or to possible natural or cultural differences.

Comparability of Jewish and Non-Jewish Children.

Age, intelligence, and training are known to affect Seashore scores (15, 16, 25) and Drake performance,[18] slight as the effects may be. Social class and musical environment are pertinent factors which the literature has not treated. To clarify the comparison in music scores, Jewish and non-Jewish children are equated in controllable factors which are directly or indirectly related to "talent." This procedure was applied to the Pittsburgh data selectively. In the St. Paul data the controls were satisfied within the initial sampling.

[17] The Y. M. C. A. clubs were playgroups organized for 10- and 11-year-olds under the self evident nomenclature of the "Indians" and the "Pioneers." Superlative testing finesse would fall short of duplicating the expected atmosphere.

[18] Unpublished data furnished by the author.

Pittsburgh Controls.

The general superiority of the Jewish group necessitated a refinement of the Pittsburgh data.[19] Trial r's yielded low positive values for Drake scores against chronological age and school progress quotients.[20] Trial averages favored the Jewish population in both chronological age[21] and PQ,[22] though the differences were not significant. The distribution of Jewish parental occupations was heavily skewed toward the upper social levels. In Drake performance the differences favored Jewish children consistently though not reliably. The original Pittsburgh group totalled 236 Jewish subjects and 207 non-Jewish subjects.

Comparability was obtained by matching Jewish and non-Jewish cases individually for age, PQ, and father's occupation. Incidental note was taken of IQ when available, and of music training when pairings were made, other things equal. In each comparison the music scores

[19] Sixty Jewish subjects attended a synagogue whose congregation is largely professional and semi-professional in social class. The average IQ of a sample within this group was 115.

[20] IQ's were available only for the public schools with a large sampling of my cases. Due to consecutive testing in several Jewish centers and to wide separation of the non-Jewish centers, most of the IQ reports were for Jewish children only. The parochial system had no IQ data.

[21] Reckoned on the day of taking the test.

[22] PQ is a ratio of the standard age for a child's grade to the child's age taken at the middle of the term. The age-grade norms are those reported by Terman for Oakland, California. (*39*, p. 257.) An assumption underlies the use of PQ for parochial schools in Pittsburgh, because of the lack of half-grade divisions. Fifth-grade children in Catholic schools were regarded as upper-five, etc., as the investigation was carried on in the second half of the year. The means and sigmas of Catholic and Protestant (non-Jewish) PQ's were indistinguishable in the original test samples. The diversity of school systems and school districts lessens the significance of PQ throughout. Notwithstanding, low positive r's against Drake performance were the rule.

on the lower half of the data cards were concealed with a blotter. In 117 comparable pairs the fathers' occupations[23] are distributed identically in these frequencies (Goodenough classification): Class I-II, N = 23; Class III, N = 30; Class V, N = 64. The pairing was practically identical within classes.

Age and PQ data are given in Table XI.

TABLE XI

Comparability Data on Pittsburgh Populations

		Mean	S.D.	N	D/σ_D
Age in months	Jewish boys	133.9	10.4	117	0.14
	Non-Jewish boys	134.1	10.7	117	
PQ	Jewish boys	104.8	6.4	117	0.12
	Non-Jewish boys	104.9	6.2	117	

Music training and the number of instruments in the home are roughly constant.[24] Both indices are superficial and highly fallible, based on the report of the subject at the conclusion of the test. Non-Jewish parents are largely native-born (U. S.), the remainder having migrated from Northwest Europe.[24] In the main, Jewish parents were born in Central Europe; and over 40 per cent of them in Russia and Poland.[24]

St. Paul Controls.

In the St. Paul data, related factors are slightly loaded in favor of Jewish performance. Age, PQ, and IQ[25] correlate positively, though unreliably, against each of the St. Paul tests. Mean IQ and PQ favor Jewish performance. Age is a non-Jewish advantage. The means are given in Table XII.

[23] The father's occupation was checked through every official source possible. With both children and adults, occupational reports were urged for the pre-depression status.

[24] See Appendix G.

[25] The IQ or Learning Ratio is based on M. J. Van Wagenen's test of general aptitude.

TABLE XII

Comparability Data on St. Paul Populations

		Mean	S.D.	N	D/σ_D
Age in months	Jewish boys	126.5	6.32	44	4.91
	Non-Jewish boys	134.7	13.08	90	
	Jewish girls	128.9	10.25	49	2.17
	Non-Jewish girls	133.2	12.41	86	
PQ	Jewish boys	106.3	6.48	44	4.46
	Non-Jewish boys	101.8	2.24	90	
	Jewish girls	106.5	6.48	49	3.63
	Non-Jewish girls	102.0	7.68	86	
IQ	Jewish boys	103.5	10.72	44	1.15
	Non-Jewish boys	101.0	13.89	90	
	Jewish girls	101.9	11.00	49	1.41
	Non-Jewish girls	98.0	21.19	86	

There is a slight Jewish superiority both in music training and in the number of instruments in the home.[26]

Again, the majority of non-Jewish parents are American born or emigrants from Northwest Europe, and over half of the Jewish parents are native to Russia and Poland.[26] Goodenough ratings of the Jewish occupations are as follows: Class I-II, 12.9%; Class III, 17.2%; Class IV-VII, 62.4%; unknown, 7.5%. Non-Jewish occupations are closely similar: Class I-II, 13.6%; Class III, 18.8%; Class IV-VII, 58.5%; unknown, 9.1%.

The Test Results.

In six tests which purport to measure basic capacities required for musical success no significant "race" difference occurs, and the direction of the difference is inconsistent. The Drake raw scores in Table XIII are the number of correct responses.

The slight Jewish superiority is a chance difference statistically and is possibly explained by the inequality

[26] See Appendix H.

TABLE XIII

"Racial" Comparisons on the Drake Musical Memory Test (Pittsburgh)

	Jewish boys (N = 117)		Non-Jewish boys (N = 117)			
	Mean	S.D.	Mean	S.D.	Diff.	D/σ_D
Drake total	40.9	11.8	40.3	10.2	0.6	0.42
"S" subtest*	10.7	4.0	10.4	3.9	0.3	0.58
"K" "	11.4	5.4	11.8	4.4	0.4†	0.60
"T" "	9.2	3.6	9.0	3.3	0.2	0.43
"N" "	9.6	3.9	9.1	3.7	0.5	1.00

INDICES OF OVERLAPPING

	Per cent Jews equal or superior to Non-Jewish mean	Per cent Non-Jews equal or superior to Jewish mean
Drake total	47.9	45.3
"S" subtest	51.3	47.9
"K" "	43.6	44.4
"T" "	57.3	43.6
"N" "	49.6	40.2

* See text for legend.

† The only non-Jewish superiority.

of the test-situations. The subtests pertain to supposed elements of musical memory. The entries in Table XIII refer to "same" (S), change of key (K), change of time (T), and change of note (N). Raw self-correlations for total Drake (same sitting) are .68±.03 for Jewish boys and .63±.04 for non-Jewish boys. The self-*r*'s, corrected by the Brown-Spearman formula, become .81±.02 and .77±.03. In total Drake score, D/σ_D, corrected for the unreliability of the measures,[27] is raised to 0.47. A retest of 31 subjects in two subgroups after a month's interval yielded a coefficient of .72±.06.

Negative evidence also occurs on the Seashore and Kwalwasser-Dykema tests which fail to distinguish reliably between Jewish and non-Jewish talent. Table XIV presents the St. Paul data.

[27] Tryon's correction (40, 41).

TABLE XIV

"Racial" Comparisons on the St. Paul Data

	Jewish children (Boys, N = 44) (Girls, N = 49)		Non-Jewish children (Boys, N = 90) (Girls, N = 86)			
	Mean	S.D.	Mean	S.D.	Diff.	D/σ_D
Seashore Pitch						
Male	64.1	14.56	64.3	13.34	0.2	0.08
Female	59.1	12.65	64.0	12.77	4.9	2.15
Combined	61.5	13.67	64.1	13.30	2.6	1.49
Seashore Intensity						
Male	72.6	11.31	75.8	4.47	3.2	1.81
Female	72.2	11.70	73.1	10.82	0.9	0.44
Combined	72.4	11.45	74.5	8.19	2.1	1.57
Seashore Tonal Memory						
Male	45.0	14.32	46.8	14.32	1.8	0.68
Female	48.4	18.28	48.4	15.49	—	—
Combined	46.8	16.61	47.6	14.87	0.8	0.39
Kwalwasser-Dykema Tonal Movement						
Male	14.7	4.24	15.8	4.58	1.1	1.38
Female	15.8	5.00	16.6	5.20	0.8	0.89
Combined	15.2	5.00	16.2	5.00	1.0	1.56

The Seashore measures are per cent right scores. Kwalwasser-Dykema performance is expressed as the number of correct answers. Fifth-grade norms (24, 25) are not strictly comparable to the data in Table XIV, because of a spread of grade-location in the latter data. The norms are roughly similar, however, though slightly and consistently higher.

A small, fairly consistent, racial difference occurs in the intercorrelation data of Table XV and Table XVI. Of the 36 raw intercorrelations, 33 are positive. As a rule, the Jewish coefficients are higher.

The evidence for higher intercorrelation among Jewish subjects is only suggestive and its mechanism is obscure. Evener motivation in the Jewish group might account for the difference, yet any decided inequality of motivation should have affected the means. The Jewish child may be a superior all-around organism by "nature." If

TABLE XV

Intercorrelations of Drake Subtests—Pittsburgh Data

	Jewish Boys (N = 117)		Non-Jewish Boys (N = 117)			
	r	PE_r	r	PE_r	Diff	D/PE_{Diff}
S and K	.36	±.05	.24	±.06	.12	1.5
S and T	.21	±.06	.15	±.06	.06	0.7
S and N	.25	±.06	.14	±.06	.11	1.3
K and T	.42	±.05	.33	±.06	.09	1.2
K and N	.43	±.05	.25	±.06	.18	2.3
T and N	.36	±.05	.25	±.06	.11	1.4

TABLE XVI

Intercorrelation of St. Paul Tests—Seashore Pitch, Intensity, Tonal Memory; and Kwalwasser-Dykema Tonal Movement

Data for boys (N — Jewish, 44; non-Jewish, 90)

	Jewish		Non-Jewish			
	r	PE_r	r	PE_r	Diff	D/PE_D
Pitch-Inten	.30	±.09	—.02	±.07	.32	2.8
Pitch-Ton Mem	.13	±.10	.38	±.06	.25	2.1
Pitch-Ton Move	—.13	±.10	.07	±.07	.20	1.6
Inten-Ton Mem	.27	±.09	.08	±.07	.19	1.7
Inten-Ton Move	.29	±.09	—.25	±.07	.54	4.7
Ton Mem-Ton Move	.21	±.10	.10	±.07	.11	0.9

Data for girls (N — Jewish, 49; non-Jewish, 86)

	Jewish		Non-Jewish			
	r	PE_r	r	PE_r	Diff	D/PE_{Diff}
Pitch-Inten	.18	±.09	.07	±.07	.11	1.0
Pitch-Ton Mem	.14	±.09	.29	±.07	.15	1.3
Pitch-Ton Move	.07	±.10	.12	±.07	.05	0.4
Inten-Ton Mem	.48	±.07	.33	±.07	.15	1.5
Inten-Ton Move	.02	±.10	.01	±.07	.01	0.1
Ton Mem-Ton Move	.32	±.09	.08	±.07	.24	2.1

so, the similarity of means is again inconsistent. Only further studies with larger sampling and superior tests can answer the question. An application of the Spearman tetrad difference formula neither suggested a general factor nor distinguished between the racial groups.

It is concluded that in so far as these tests embrace the innate basis of musicianship, and in so far as the

sampling and technique of this study are adequate, special musical endowment fails to account for the striking musical activity of adult Jews.

III. Historical and Theoretical Interpretation

Jewish history is sufficiently unlike that of other culture groups to merit a statement of Jewish musicalness in terms of distinctive social forces. The validity of the environmental formulation by no means rules out the possibility of hereditary differences.

(1) National origins have affected Jewish art. The majority of our Jewish virtuosi sprang from a foreign culture which can hardly be compared to the musical tradition of contemporary America. They emanated from Central Europe, particularly from Hungary, Poland, and the Ukraine—milieus richly steeped in musical culture.

(2) Music has constituted an available profession in a society where Jewish survival in other walks is either impossible or relatively more difficult. In addition, it is an open sesame to a Nordic society which appropriates the artist regardless of ancestry. Furthermore Nordic tolerance rests on its own indifference to the musical career—at least, in America—and a vague feeling that Jews have more musical talent to begin with.

(3) Jewish people have been town-dwellers, historically, due to legal requirement or to the urban nature of possible Jewish employments. Now, perhaps, due more to custom and preference. The Jewish population from which many American artists emigrated is densely urbanized. The association between musical culture and an urban civilization is obvious.

(4) Greater respect for learning and the arts is undoubtedly close to a long Jewish tradition. Rooted in economics and religion originally, Jewish intellectual-

ity has been preserved by religion, *esprit de corps,* and existing social circumstances.

(5) Sheer race pride impels Jewish attainment. Jewish norms in other professions duplicate somewhat the picture of musical eminence. It is not unnatural that the intense drive necessary to produce the finished virtuoso should occur more frequently among a people relatively suppressed for centuries.

(6) Escape from the formal school system has something to do with the profusion of European, incidentally Jewish European, musical artists. An impressive number of our virtuosi were infant prodigies who were placed very early under master-pedagogues and in great conservatories. The precocity is not underestimated, but the early tuition of high caliber is equally important.[28]

(7) The border cities of west and southwest Russia beautifully epitomize the Jewish impetus towards music. Notable in the Russian situation were the renaissance which swept Jewish Russia in the 19th century, the rich musical culture of Central Europe and the Near East, the fact that musicians were exempt from residence in The Pale of Settlement, the patronage of Jewish com-

[28] A fragmentary list was prepared from the program notes of the leading orchestras (*31*). Tuition under a master-teacher or in an important conservatory was under way at the following ages for various artists: At 3, Rubenstein; at 5, Heifetz; at 6, Barth, Schelling, and Schnabel; at 7, Enesco, Huberman, Levitzki, and Spalding; at 8, Burgin, Hofmann, Kindler, Lhévinne, Rosenthal, and Vecsey; at 9, Kochanski, Moïséiwitsch, Stravinski, and Zimbalist; at 10, Casella, Elman, Flesch, Ganz, Grainger, Godowsky, and Ornstein; at 12 Bartók, Casals, Dushkin, Paderewski, Prokofieff, Salmond, and Siloti; at 13, Copeland, Gordon, Iturbi, Poliakin, Shattuck, Szigeti, and Thibaud; at 14, Culbertson, Horowitz, Lamond, Sanromá, and Zecchi; at 15, Samuel and Piatigorsky; at 16, Gabrilowitsch, Gieseking, and Mischakoff. Competent teaching began even earlier than the figures indicate because in many cases the reported ages are for the debut or graduation from the conservatory.

mittees which subsidized exceptional talent, and the like. National persecutions then induced the wave of Jewish migration to the United States at the turn of the century.[29]

(8) Jewish fondness for the violin has certain social and habitual roots. The instrument is inexpensive. It had a religious precedent in the Oriental Chassidic styles. The professional demand is greater for this instrument. However established, the Jewish flair for the violin could have perpetuated itself by tradition, i. e., that more Jewish parents expose their children to the violin in the belief that a child may "have it in him." The greater expressiveness of the violin and an opportunity for display would make the instrument a Jewish favorite, if the reputed emotional Jewish temperament is a fact.

(9) Cutting across the previous points, Jewish temperament may favor musical achievement. In its acquired elements, emotionality—as related to repression, literally or symbolically—could add warmth to the introspective power of a mature artist. This coloring is surely found in Jewish composition. Also, the phenomenon of "letting go" in artistic performance probably has more than the ordinary compensatory significance among Jewish performers. If this vaguely defined temperament is a "natural" Jewish characteristic, due to selection, the corresponding anatomic entities are as yet unidentified.

The Nature-Nurture Problem.

The earlier measurement data do not warrant a flat denial of a superior musical heredity in Jews. However, the evidence for innate Jewish superiority in musical

[29] One-fifth of the entire Jewish population of Eastern Europe emigrated between 1880 and 1912. (*9*, pp. 214, 218.) Musicians constituted 21 per cent of the Jewish immigrants (U. S.) in the liberal professions at the time of entry.

capacity—however defined[30]—has yet to be established, and the findings of this study are negative.

By analogy, the general history of music does not reveal any single national preëminence, even without the plaguing concept of race entering in. Witness the mobility of musical supremacy from the Netherlands in the 15th century, to England in the 16th century, to Italy in the 17th century, to Germanic countries in the 18th and 19th centuries, and possibly to Russia in the early 20th century. Moreover, the rule for seven centuries of western music has been eclecticism and inter-action of cultures, all integral with large social movements. Quite apart from the present measurements, current Jewish musical activity is no more evidence of a special musical endowment than can innate tendencies be posed, *a priori*, to explain Jewish dominance in Arabic medicine or map-making in Mallorca in the 15th century.

If Jewish musicality is finally reduced to motivation, superimposed on natural equipment which is very similar to that of other culture groups, all critics must acknowledge the brilliance and relative desirability of the adjustment. Its final value must be weighed in terms of the general social conditions out of which the adjustment has arisen.

Conclusions

(1) Jewish incidence among "American" musicians exceeds expectancy significantly.

(2) Roughly 50 per cent of the violin-virtuosi, and the maestros and first violinists of American symphony orchestras are of Jewish origin. One-quarter to one-half of the piano-virtuosi and of all symphonic and amusement instrumentalists are Jewish. Ten per cent of "American" composers are of Jewish extraction.

[30] Intelligence, physique, emotionality, motor dexterity, or what not.

(3) Comparable Jewish (N = 200) and non-Jewish (N = 300) children aged 10-11 years are equally endowed in basic musical traits.

(4) The "aptitude" battery utilizes five tests: Seashore pitch, Seashore intensity, Seashore tonal memory, Kwalwasser-Dykema tonal movement, and Drake musical memory.

(5) Historic social forces have stimulated Jewish musicality intensely.

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APPENDIX A

Permanent Maestros of 12 American Orchestras (Season of 1932-33), and Guest-Conductors of the Boston, Chicago, New York Philharmonic, and Philadelphia Orchestras, 1920-21 to 1932-33*

Sir Thomas Beecham, Artur Bodanzky, Richard Burgin, Walter Damrosch, Eric Delamarter, Issay Dobrowen, Enrique Fernandez-Arbos, Wilhelm Furtwaengler, Ossip Gabrilowitsch, Vladimir Goltschman, Eugene Goossens, Sir George Henschel, Alfred Hertz, Erich Kleiber, Otto Klemperer, Serge Koussevitzky, Clemens Krauss, Hans Lange, Willem Mengelberg, Emil Mlynarski, Bernardino Molinari, Pierre Monteux, Eugene Ormandy, Erno Rapée, Fritz Reiner, Thaddeus Rich, Artur Rodzinski, Ernest Schelling, Tullio Serafin, Alexander Smallens, Nicolai Sokoloff, Frederic Stock, Albert Stoessel, Leopold Stokowski, Arturo Toscanini, Willem Van Hoogstraten, Bruno Walter. (N = 37.)

APPENDIX B

Instrumentalists Who Appeared as Soloists with the Boston, Chicago, New York Philharmonic, or Philadelphia Orchestras, 1920-21 to 1932-33

VIOLINISTS (N = 59)

Louis Bailly,[1,2] Adolphi Betti,[2] Remo Bolognini, Richard Burgin,[3] Adolph Busch, Carlton Cooley, John Corigliano, Sascha Culbertson, Samuel Dushkin, Mischa Elman, Georges Enesco, Carl Flesch, Samuel Gardner, Jacques Gordon,[3] Scipione Guidi, Michel Gusikoff,[3] Jascha Heifetz, Alexander Hilsberg,[3] Bronislaw Huberman, Sascha Jacobsen, Paul Kochanski, Fritz Kreisler, Bernard Kugel, Hans Lange, Jean Lefranc,[1,3] Samuel Lifschey,[1,3] Alfred Megerlin, Yehudi Menuhin, Nathan Milstein, Mischa Mischakoff, Grisha Monasevitch,[3] Hans Muenzer, Bernard Ocko, Mishel Piastro, Alfred Pochon,[2] I. Pogany, Miron Poliakin, Michael Press, Benno Rabinoff, Thaddeus Rich,[3] Max Rosen, Sam Rosen,[1,3] Leon Sametini, Alexander Schmuller, Oscar Shumsky, Toscha Seidel, Arrigo Serato, Stefan Sopkin, Albert Spalding, Joseph Szigeti, Emil Telmányi, Lionel Tertis,[1] Jacques Thibaud, Ferenc Vecsey, Romain Verney,[1,3] Joseph Vieland,[1] Harry Weisbach,[3] Efrem Zimbalist, Alexander Zukowsky.[3]

* Boston, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, Minneapolis, New York (Philharmonic), Philadelphia, St. Louis, San Francisco, and the RKO Symphony Orchestra at Radio City.

VIOLINCELLISTS (N = 21)

Iwan d'Archambeau,[2] Jean Bedetti,[3] Ennio Bolognini, Pablo Casals, H. D. Goudoener, Gerard Hekking, Joseph Hollman, Hans Kindler, Joseph Malkin, Maurice Marechal, Michel Penha,[3] Gregor Piatigorsky, Hanns Pick,[3] Daniel Saidenberg, Felix Salmond, Alwin Schroeder, Leo Schulz, Willem Van Den Burg,[3] Cornelius Van Vliet, Alfred Wallenstein, Willem Willeke.

PIANISTS (N = 65)

Clarence Adler, Horace Alwyne, Claudio Arrau, Wilhelm Bachaus, Harold Bauer, Alfred Blumen, Alexander Borovsky, Alexander Brailowsky, Joseph Brinkman, George Copeland, Alfred Cortot, Henri Deering, Oliver Denton, Issay Dobrowen, Lester Donahue, Carl Friedberg, Ossip Gabrilowitsch, Rudolph Ganz, Heinrich Gebhard, Walter Gieseking, Leopold Godowsky, Percy Grainger, Josef Hofmann, Vladimir Horowitz, Ernest Hutcheson, José Iturbi, Harry Kaufman, Leonid Kreutzer, Zoltan Kurthy, Frederick Lamond, Edward Lane, Earle D. Laros, Mischa Levitzki, Josef Lhévinne, Guy Maier, Benno Moïséiwitsch, Mieczyslaw Münz, Mitja Nikisch, Erwin Nyiregyhazi, Nikolai Orloff, Ignace Paderewski, Lee Pattison, Egon Petri, Leo Podolsky, Serge Rachmaninoff, Rudolph Reuter, Edouard Risler, Moriz Rosenthal, Arthur Rubenstein, Kurt Ruhrseitz, Harold Samuel, Jesús Mariá Sanromá, Kurt Schindler, E. Robert Schmitz, Artur Schnabel, David Saperton, Arthur Shattuck, Frank Sheridan, Alexander Siloti, Bruce Simonds, David Sokolove, Sigismond Stojowski, Andrée Vaurabourg, Bruno Walter, Carlo Zecchi.

[1] Viola-player.
[2] Member of the Flonzaley ensemble.
[3] A permanent member of one of the four orchestras. The symbol is omitted for players who have appeared with two or more of the four orchestras.

APPENDIX C

Women Artists Who Appeared as Soloists with the New York Philharmonic Orchestra, 1920-21 to 1932-33

VIOLINISTS (N = 8)

Yelli d'Aranyi, Ruth Breton, Cecelia Hanson, Joan Manon, Erika Morini, Erna Rubenstein, Helen Teschner Tas, Catherine Wade-Smith.

PIANISTS (N = 16)

Katherine Bacon, Ellen Ballon, Maria Carreras, Gitta Gradova, Margaret Hamilton, Myra Hess, Wanda Landowska,* Madeleine Marshall, Yolanda Merö, Elly Ney, Eunice Norton, Guiomar Novaes, Olga Samaroff, Germaine Schnitzer, Antoinette Szumowska, Germaine Tailleferre.

* Harpsichordist.

APPENDIX D

Supplementary List of American Composers, Compiled by Dr. Charles Boyd

Frederic Ayres, Edward Shippen Barnes, Philip Paul Bliss, Jr., Elias Blum, Louis Campbell-Tipton, Philip Greeley Clapp, Chalmers Clifton, Blair Fairchild, Karl Flodin, Pietro Floridia, Cecil Forsyth, Charles Rudolph Friml, Charles Tomlinson Griffes, Hugo Grimm, Chester Edward Ide, T. Tertius Noble, Kurt Schindler, Mortimer Wilson. (N = 18.)

APPENDIX E

Composers Who Appeared as Guest-Artists with the Boston, Chicago, New York Philharmonic, or Philadelphia Orchestras, 1920-21 to 1932-33

COMPOSER-PIANISTS (N = 23)

Hans Barth, Béla Bartók, John Alden Carpenter, Alfredo Casella,[1] Abram Chasins, Edward Collins,[1] Aaron Copland, Ernst von Dohnányi, George Gershwin, Nicolas Medtner, Darius Milhaud,[1] Harold Morris, Leo Ornstein, Ildebrando Pizzetti, John Powell, Serge Prokofieff,[1] Ottorino Respighi,[1] Ernest Schelling,[1,2] Cyril Scott, Leo Sowerby, Igor Stravinsky,[1] Alexander Tansman,[1] Ernest Toch.

COMPOSER-CONDUCTORS (N = 18)

Chalmers Clifton, Eric Delamarter,[3] Henry Eichheim, Georges Enesco,[4] Samuel Gardner,[4] Alexander Glazounov, Henry Hadley, Howard Hanson, Gustav Holst, Arthur Honegger, Vincent d'Indy, Carl McKinley, Walter Piston, Maurice Ravel, Richard Strauss, Joseph Stransky, Nikolai Tcherapnin, Herman Hans Wetzler.

COMPOSER-VIOLINIST

Nicolai Berezowsky.

[1] Composer-performer who appeared both as conductor and as pianist.
[2] Also listed as pianist and conductor.
[3] Also listed as conductor.
[4] Also listed as violinist.

APPENDIX F

Nativity of Conductors, Composers, Symphonists, and Concert-Artists

	Pianists		Violinists		Violoncellists	
	Jewish	Non-Jewish	Jewish	Non-Jewish	Jewish	Non-Jewish
Australia	—	2	—	—	—	—
Austria	1	1	1	1	—	—
Bohemia	—	—	—	—	—	—
Czecho-Slovakia	1	—	—	—	—	—
England	2	2	—	1	—	1
Finland	—	—	—	—	—	—
France	—	3	—	3	—	3
Germany	2	6	—	2	—	1
Holland	—	—	1	—	1	6
Hungary	—	1	2	3	—	—
Italy	—	1	—	3	—	—
Mexico	—	—	—	—	—	—
Poland	3	2	4	—	—	1
Porto Rico	—	1	—	—	—	—
Roumania	—	—	1	1	—	—
Russia	11	4	15	1	2	—
So. America	—	1	—	1	—	1
Spain	—	1	—	—	—	1
Switzerland	—	2	—	—	—	1
Turkey	—	—	—	1	—	—
United States	3	11	4	7	—	2
Unknown	—	4	—	7	—	1
TOTAL	23	42	28	31	3	18

APPENDIX F (continued)

Nativity of Conductors, Composers, Symphonists, and Concert-Artists

	American Composers Reis-Boyd Criterion		Composers Selected by Orchestra Appearance		Orchestra maestros	
	Jewish	Non-Jewish	Jewish	Non-Jewish	Jewish	Non-Jewish
Australia	—	2	—	—	—	—
Austria	—	—	—	1	1	2
Bohemia	1	—	1	—	—	—
Czecho-Slovakia	—	1	—	—	—	—
England	—	4	—	2	—	3
Finland	—	1	—	—	—	—
France	—	4	2	2	2	—
Germany	1	4	—	2	5	2
Holland	—	2	—	—	—	2
Hungary	1	1	—	2	2	—
Italy	—	3	—	2	—	4
Mexico	—	1	—	—	—	—
Poland	—	1	1	—	1	1
Porto Rico	—	—	—	—	—	—
Roumania	—	—	—	1	—	—
Russia	6	3	2	6	5	—
So. America	—	—	—	—	—	—
Spain	—	—	—	—	—	1
Switzerland	1	—	—	—	—	—
Turkey	—	—	—	—	—	1
United States	11	96	4	9	—	4
Unknown	—	1	—	5	1	—
TOTAL	21	124	10	32	17	20

APPENDIX F (concluded)

Nativity of Conductors, Composers, Symphonists, and Concert-Artists, Present Members of the Boston and Philadelphia Orchestras

	Violinists	All Strings	Woodwind	Brass
Austria	—	1	2	2
Belgium	—	2	—	2
Bohemia	—	—	—	2
Czecho-Slovakia	—	1	1	2
England	1	3	3	—
France	4	14	9	6
Germany	2	8	2	1
Holland	1	4	1	1
Hungary	1	3	—	—
Italy	1	1	3	1
Moravia	—	—	1	—
Poland	5	5	—	2
Roumania	2	2	—	—
Russia	8	12	—	1
Spain	—	1	—	—
United States	20	38	7	7
Unknown	23	38	6	11
TOTAL	68	133	35	38

APPENDIX G

Data on the Comparability of Jewish and Non-Jewish Children in Pittsburgh

I. Number reporting musical instruments in the home

Type of instrument*	Jewish boys (N = 117)		Non-Jewish boys (N = 117)	
	N	%	N	%
Piano	65	55.6	70	59.8
Violin	46	39.3	41	35.0
Victrola	92	78.6	63	53.8
Radio	105	89.7	90	76.9
Miscellaneous	19	16.2	24	20.5
None	1	0.9	5	4.3

* Entries refer to individuals, not instruments.

II. Number reporting private lessons on one or more instruments

	Jewish boys (N = 117)		Non-Jewish boys (N = 117)	
	N	%	N	%
Piano	21	17.9	31	26.5
Violin	18	15.4	16	13.7
Miscellaneous	11	9.4	17	14.5
No training	74	63.2	63	55.8

III. Nativity of parents of Pittsburgh children

	Jewish parents (N = 234)		Non-Jewish parents (N = 234)	
	N	%	N	%
Northwest Europe[1]	3	1.3	35	15.0
S.E.-Central Europe[2]	127	54.3	1	0.4
Miscellaneous[3]	18	7.7	4	1.7
U. S. A.	70	29.9	157	67.1
Unknown	16	6.8	37	15.8
Russia & Poland[4]	96	41.0	0	0.0

[1] British Isles, France, Germany, and Scandinavia.
[2] Austria, Hungary, Lithuania, Poland, Roumania, and Russia.
[3] Australia, Greece, Italy, and Spain.
[4] Included under S.E.-Central Europe.

APPENDIX H

Data on the Comparability of Jewish and Non-Jewish Children in St. Paul

I. Number reporting musical instruments in the home

Instruments*	Jewish children (N = 93)		Non-Jewish children (N = 176)	
	N	%	N	%
Piano	53	57.0	70	39.8
Victrola	56	60.2	95	54.0
Radio	71	76.0	136	77.3

* Entries refer to individuals, not instruments.

II. Number reporting private lessons on the piano

	Total N	N with training	% with training
Jewish	93	26	28.0
Non-Jewish	176	40	22.7

III. Nativity of parents of St. Paul children

	Jewish parents (N = 186)		Non-Jewish parents (N = 352)	
	N	%	N	%
Northwest Europe	11	5.9	40	11.3
S.E.-Central Europe[1]	118	63.4	8	2.3
Miscellaneous[3]	10	5.4	20	5.7
U. S. A.	37	19.9	220	62.5
Unknown	10	5.4	64	18.2
Russia & Poland[4]	103	55.4	--	---

[1] British Isles, France, Germany, and Scandinavia.
[3] Austria, Hungary, Lithuania, Poland, Roumania, and Russia.
[3] Italy, Spain, and Switzerland.
[4] Included under S.E.-Central Europe.

THE LEGIBILITY OF TYPEWRITTEN MATERIAL

EDWARD B. GREENE*
University of Michigan

Methods of Measuring Legibility

The General Problem.

In order to evaluate accurately legibility of printed matter there are at least three physical and three behavior variables which must be adequately controlled. The physical variables are the minimum time, distance and illumination needed for a standard reading operation. The three behavior variables are changes in motivation, fatigue, and the motor and mental processes involved in reading a standard passage. These are neither entirely independent nor directly measurable. In some test situations they seem to change a great deal so that they may cause important errors.

From the foregoing consideration of variables it seems that legibility, that is the ease of being read, does not depend entirely on objective attributes, such as size, spacing, etc., but that it also depends on the condition and training of the reader. Thus a person who has been trained to read German script of a certain size will probably find this more legible than other scripts or other sizes. This means that legibility cannot be measured

* This study was made possible by the cordial cooperation of Prof. H. H. Remmers of Purdue Univ., Prof. Robert C. Binkley of Western Reserve Univ., Prof. C. N. Anspach of Mich. State Normal College, Prof. A. D. Moore of the School of Engineering and Prof. Roy W. Cowden of the College of Literature, Science and Arts at the Univ. of Michigan. The printing firm of Edwards Bros., Ann Arbor, Mich., furnished the test forms and aided the study with many thoughtful courtesies.

directly but that the relative efficiency of various samples may be found under standard conditions of training and measuring.

Evaluation of Methods.

Practically all evaluations of legibility have assumed that it was commensurate with the minimum time or illumination, or the maximum distance at which certain samples could be read. A common technique is to vary one of these while keeping the other two constant. The minimum time is probably the best indicator of legibility under ordinary reading conditions, because the tests of distance or illuminating require eye accommodations which are not typical of reading situations. Minimum time may be measured in two ways, the laboratory method, tachistoscopic, (3), in which a sample is exposed for from 1/20 to 1/10 second, and the class room method in which the material is read under fairly normal reading conditions for periods of 2 minutes or more. The tachistoscopic method controls illumination and distance better than the class room method but it can be applied to only one subject at a time and it is not suited to the evaluation of length of line, spacing, or problems involving eye movements. Since this study was interested in spacing effects, the class room method was chosen.

All of these methods usually fail to a considerable degree to control behavior variables such as motivation, energy, fatigue, practice effects. It is probably a fairly common phenomenon to observe increases in the expenditure of energy to overcome increases in difficulty. In this study we have tried to reduce behavior variables by

1. The comparison of fairly large groups where individual variations of a chance variety tend to cancel each other and thus fail to influence the group scores.

2. The use of class periods regularly given to similar activities: *i. e.*, the study of reading or language, or to test situations.
3. The use of preliminary practice training periods of 2 minutes.
4. The elimination of records of students who did not comply with directions through poor motivation or ability.

Procedure.

The relative efficiency of various samples was evaluated by the method of equivalent groups similar to that used by Paterson and Tinker (5), in which two or more groups of students are given two tests. The first test is the same for all groups. It is used to determine the equality of the groups in reading ability and to set standards for comparison with the second test. The second test is a form equivalent in difficulty and length to the first test but differing in content. For one group, called the control group, the second test is printed in the same style as the first test. For the other groups, called the experimental groups, the second test is printed in various other sizes and styles. The comparison of the gains or losses from the first to second tests of the control and experimental groups indicates the relative legibility of the samples, if all other possible factors in speed and accuracy of reading have been eliminated.

Such raw scores, however, do not indicate whether the differences noted are large enough to be reliable or important. An interpretation of our results, therefore, can only be made from the comparison of relative improvement. There are two measures of relative improvement commonly used, the per cent of improvement, and the reliability of a difference. The per cent of improvement method has a limited application here because we do not have a measure from the zero of performance nor any

well marked practice or growth curves. The reliability of a difference method can be applied to the data on hand because it depends solely upon the size of population and the dispersion of scores, (2. p. 182)

$$\text{SD Diff.} = \sqrt{SD_1^2 + SD_2^2 - 2\,r\,SD_1\,SD_2}$$

It is generally stated as a ratio of the difference between means and the standard deviation (S.D.) of this difference. If the difference is three times its own S.D. there is practically no probability that a more adequate sampling would reverse the conclusions, hence such a difference is said to be statistically reliable. In the following tables the records of the control groups are given first and those of experimental groups later. The right hand column gives the ratios for each group; the larger ratios indicate more reliable improvement even though the raw score differences are sometimes at variance with the ratios.

The Tests.

A testing instrument was desired which would give a reliable score for easy reading in terms of equal units, which would allow little guessing or chance success, and which would continue over a long enough period to measure more than just an initial spurt. The Chapman-Cook test seemed to have most of these requirements except the necessary length. Therefore two new test forms, called the Michigan Speed of Reading Test I and II, were devised following the Chapman-Cook plan. These consist of one hundred paragraphs each, thirty words in length and of similar complexity. In each paragraph there is one word in the last part which spoils the meaning for the first part. The task is to find the wrong word and cross it out. In order to do this it is necessary to read nearly the whole paragraph, for each part alone

makes sense and it is only by comparing the two halves that the wrong word is found. The words were chosen with few exceptions from the easiest 5000 of the *Teachers' Word Book* (6). The subject matter came from school and home situations common to third and fourth grade children.

The Subjects.

College students were chosen for this study for the following reasons:

1. Norms for college groups were desired because books and magazines prepared by litho-printing are most often used by college trained persons. Another report (1) gives the norms for grade and high school groups.

2. It seemed probable that more chance errors would be avoided in college groups than in younger and more heterogeneous groups by the better reading coordination and cooperation of college students.

3. It seemed probable that students with the broadest reading experience would have the information and technique to meet the test situation with a minimum of bias from previous practice with a particular type.

4. It was desired to compare this work with that of previous investigators who have used college groups.

Approximately 1950 students took part in this program in April and May of 1932 at Purdue University, Western Reserve University, Michigan State Normal College, and the University of Michigan. Of these approximately 640 were freshmen, 950 sophomores, 210 juniors and 150 seniors. The selection of these students was made largely on the basis of availability from English and Psychology classes, and from a freshman engineering assembly. The students were told briefly the nature of the study and good cooperation was obtained.

The Administration of Tests.

All the tests were administered to groups of students during the twenty-five minute period as part of the regular recitation or laboratory period. The directions were read by the instructor while the students worked over five sample problems, and were given the correct answers for the samples. A 1¾ minute practice test was given to allow more familiarity with the technique. Ten minutes were allowed for each test and the students were asked to make a figure 5 in the margin for each test to show their progress at the end of five minutes.

The size of the groups varied from fourteen to one hundred thirty-six students with a mean size of forty-three. It was thought desirable to secure eighty students or more for each experimental variable, therefore in some cases several classes of students have been grouped together.

Printing.

All of the samples were lithoprinted from typewritten material on a white bond paper. Both sides of the paper were used. The paper was either stitched or folded into booklets, 8½ by 11 inches.

Accuracy.

The average accuracy for all groups considered is 97.7 per cent correct, S. D. 2.1 per cent. There were no constant tendencies for more errors to appear in smaller or larger sizes of type. The accuracy scores have therefore been omitted from the following tables. The corrections between the number of items attempted and the number correct averaged .969, S. D. .032. The results given hereafter are all expressed by the number of paragraphs correctly marked in a ten minute period. Each paragraph contained thirty words. Therefore the words read per minute can be calculated by multiplying the number correct (mean score) by 30/10 or 3.

The results are considered under three headings: size of type, leading, and length of line or width of column.

THE RESULTS

A. Size of Type.

The sizes of type investigated were chosen because of their common usage as follows:

TABLE I

Type Specifications

No.	Description	Height	Letters per inch	Length of Line In.	Length of Line MM.	Lines per inch
A1	Typewriter	14 pt.	10	6.87	176	6
A3	Typewriter	12 pt.	12	6.87	176	6
D	Typewriter	10 pt.	12.5	6.87	176	7.8
F	Typewriter	7 pt.	14	6.87	176	8.2

In order to evaluate these samples with the length of time kept constant, Tests I and II were printed in all four sizes. The results of applying them to fairly equivalent groups of students are shown in Tables II, III, and IV. Table II shows the results when 10 pt. script was used in all groups for Test I, and for the control group in Test II, and when the other samples were used for Test II in the experimental groups. Table III shows the results for similar procedures using 14 pt. typewriter pica, and Table IV, for the 7 pt. sample. These tables may be summarized in part as follows:

1. All tables show a tendency for Test II to be worked a little more rapidly than Test I. The average improvement is 2.6 items. This improvement is generally about 1.8 times its own S. D. so that it cannot be considered to be statistically very reliable. This improvement is probably due to practice since the two forms were found to be approximately equivalent in a previous study, (1).

2. There is no reliable tendency for one size to be read more easily than any other size. Thus in Table II the 12 pt. and 7 pt. both show more relative improvement, (ratio) than the 10 pt. In Table III the 7 pt., 10 pt., and 12 pt. all seem a little more efficient than the 14 pt. but the differences are small enough to be easily reversed by chance variations. In Table IV the 14 pt. and 12 pt. show a little more relative improvement than the 7 pt. and the 7 pt. is ahead of the 10 pt.

We must conclude from these results that whatever differences in legibility there might have been under these conditions they were so small as to be overshadowed by such uncontrolled variables as past training, motivation, and fatigue, etc. The experimenter observed that the smaller types were generally held a little closer to the eyes than the larger sizes. These results seem at variance with those reported by Tinker and Paterson (5) in which they found the optimum size to be at or near the 10 pt. for linotyped material. The discrepancies may be due to the differences in type face or test periods of the two investigations or to other variables. Further experimental work would be necessary to evaluate these factors.

TABLE II

Size of Type; 10 pt. Typewriter Standard

Group	N	Test	Size	Means	S. D. Mean	Diff. II-I	S. D. Diff	Ratio*
1.	104	I	10 pt.	69.1	1.15			
		II	10 pt.	70.2	1.04	1.1	.901	1.221
2.	93	I	10 pt.	65.3	1.22			
		II	14 pt.	67.6	1.15	2.3	1.34	1.715
3.	89	I	10 pt.	64.5	1.02			
		II	12 pt.	73.5	0.76	9.0	1.02	8.835
4.	67	I	10 pt.	68.3	1.20			
		II	7 pt.	76.0	1.15	7.7	1.31	5.872

* Ratio equals difference between means divided by its own S. D. In order to represent a thoroughly reliable difference, the ratio must equal or exceed 3.0.

TABLE III

Size of Type: 14 pt. Typewriter Pica Standard

Group	N	Test	Size	Means Mean	S. D.	Diff. II-I	S. D. Diff.	Ratio
1.	93	I	14 pt.	64.1	1.21			
		II	14 pt.	65.2	1.29	1.1	1.39	.791
2.	72	I	14 pt.	66.4	1.43			
		II	12 pt.	70.1	1.24	3.7	1.57	2.294
3.	84	I	14 pt.	69.2	1.33			
		II	10 pt.	71.3	0.98	2.1	1.31	1.601
4.	107	I	14 pt.	67.4	1.34			
		II	7 pt.	69.8	1.47	2.4	1.47	1.661

TABLE IV

Size of Type: 7 pt. Typewriter

Group	N	Test	Size	Means	S. D. Mean	Diff. II-I	S. D. Diff.	Ratio*
1.	68	I	7 pt.	70.6	1.27			
		II	7 pt.	71.7	1.19	1.1	1.39	.791
2.	93	I	7 pt.	67.4	1.32			
		II	14 pt.	72.3	1.40	4.9	1.48	3.302
3.	81	I	7 pt.	69.4	1.07			
		II	12 pt.	73.1	1.21	3.7	1.37	2.701
4.	74	I	7 pt.	71.2	1.39			
		II	10 pt.	72.4	1.45	1.2	1.66	.723

B. Leading.

Because leading is not customarily used in the 12 and 14 pt. types the investigation of differences in leading included only the 10 pt. and the 7 pt. typewriter. Each size, set solid, was compared with the same size samples set with leads. In the 10 pt. sample a 3 pt. lead was introduced and in the 7 pt. sample, a 1.2 pt. lead. Two lengths, 88 mm. and 176 mm., were used. The results which are shown in Tables V and VI indicate a slight tendency for the leaded samples to be read more rapidly than the solid, and this tendency is more noticeable for the longer line than the shorter. None of the differences, however, are statistically reliable as shown by the ratios

TABLE V

Effects of Leading 10 pt. Typewriter

Group	N	Test	Lead	Line mm	Lines per Inch	Means	S.D. Mean	Diff.	S.D. of Diff.	Ratio
1.	104	I	Solid	176	7.8	69.1	1.15			
		II	Solid	176	7.8	70.2	1.04	1.1	.90	1.221
2.	87	I	Solid	176	7.8	78.1	.91			
		II	Leaded	176	6.0	82.7	1.43	4.6	1.25	3.68
3.	82	I	Solid	88	7.8	69.2	1.15			
		II	Solid	88	7.8	70.3	1.05	1.1	.89	1.337
4.	79	I	Solid	88	7.8	68.7	1.26			
		II	Leaded	88	6.0	70.1	1.14	1.4	1.05	1.332

TABLE VI

Effects of Leading 7 pt. Typewriter

Group	N	Test	Lead	Line mm	Lines per Inch	Means	S.D. Mean	Diff.	S.D. of Diff.	Ratio
1.	68	I	Solid	176	8.2	70.6	1.27			
		II	Solid	176	8.2	71.7	1.19	1.1	1.39	.791
2.	98	I	Solid	176	8.2	67.5	2.01			
		II	Leaded	176	7.0	75.4	2.02	7.9	2.12	3.722
3.	129	I	Solid	88	8.2	70.9	1.10			
		II	Solid	88	8.2	73.6	1.42	2.7	1.29	2.093
4.	84	I	Solid	88	8.2	69.4	2.11			
		II	Leaded	88	7.0	75.4	2.02	6.0	2.09	2.864

of the differences between the means divided by their own sigmas. There was a saving of time when the leaded sets were used of between .4 per cent and 7.1 per cent of the ten minute periods used. The mean saving was approximately 3.3 per cent. This difference is so small that it might be overcome by small practice effects.

C. Length of Line.

Two widths of column were examined experimentally, 176 mm. and 88 mm., keeping all other typographical factors constant. Two sizes of type were employed, 10 pt. and 7 pt. typewriter and the four varieties of interlinear spacing noted in the previous section.

Tables VII and VIII show the results. These tables may be summarized in part as follows:

1. There is a very slight tendency in both the solid and leaded samples for the wider columns to be read more slowly than the narrower. This tendency is nowhere statistically reliable but it appears in six of the eight comparisons. The average saving of the 88 mm. columns over the 176 mm. is approximately 1.1 per cent.

2. The introduction of leading does not change the results in any typical or reliable way. Some have supposed that the wider interlinear spaces would aid aggressive eye movements but the results show no improvement for groups of this kind. These results in part confirm the work of Tinker and Paterson (4) who used a 10 pt. linotype sample set solid on lines of the following lengths: 58, 80, 96, 113, 134, 151, 168, and 184 mm. They found that the 80 mm. line was read a little faster than any other during a 1¾ minute period. However, our results are not as striking as are theirs. It is possible that the differences may have come from the differences in test periods.

The 10 minute periods used in this study may allow certain patterns of response to be developed during the

TABLE VII

Length of Line, 10 pt. Typewriter

Group	N	Test	Line	Leading	Means	S.D. Mean	Diff.	S.D. Diff.	Ratio
1.	104	I	176	Solid	69.1	1.15			
		II	176	Solid	70.2	1.04	1.1	.90	1.221
2.	79	I	176	Solid	64.3	2.01			
		II	88	Solid	69.1	1.87	4.8	2.05	2.340
3.	82	I	88	Solid	69.2	1.15			
		II	88	Solid	70.3	1.05	1.1	.89	1.337
4.	81	I	88	Solid	72.4	1.76			
		II	176	Solid	76.6	1.69	4.2	1.84	2.282
5.	79	I	176	3 pt.	64.5	1.94			
		II	176	3 pt.	68.8	1.87	4.3	2.13	2.020
6.	85	I	176	3 pt.	66.3	1.84			
		II	88	3 pt.	72.4	2.03	6.1	1.95	3.124
7.	74	I	88	3 pt.	70.1	1.74			
		II	88	3 pt.	73.3	1.63	3.2	1.84	1.739
8.	65	I	88	3 pt.	70.7	1.98			
		II	176	3 pt.	71.4	1.74	.7	2.20	.318

TABLE VIII

Length of Line, 7 pt. Typewriter

Group	N	Test	Line	Leading	Means	S.D. Mean	Diff.	S.D. Diff.	Ratio
1.	68	I	176	Solid	70.6	1.27			
		II	176	Solid	71.8	1.09	1.1	1.39	.79
2.	91	I	176	Solid	74.6	1.62			
		II	88	Solid	74.2	1.45	0.4	1.73	.23
3.	129	I	88	Solid	70.9	1.10			
		II	88	Solid	73.6	1.42	2.7	.76	2.093
4.	67	I	88	Solid	67.3	1.24			
		II	176	Solid	69.2	1.32	1.9	1.41	1.49
5.	65	I	176	1.2 pt.	72.2	1.39			
		II	176	1.2 pt.	74.4	1.71	2.2	1.63	1.10
6.	78	I	176	1.2 pt.	69.3	1.58			
		II	88	1.2 pt.	71.4	1.74	2.1	1.85	1.13
7.	76	I	88	1.2 pt.	72.7	1.84			
		II	88	1.2 pt.	74.2	1.63	1.5	1.98	.75
8.	93	I	88	1.2 pt.	72.6	1.25			
		II	176	1.2 pt.	74.2	1.35	1.6	1.38	1.16

test period to a point of greater efficiency than during the 1¾ minute period used by them. A well practiced habit probably will not show as much improvement as one which is less practiced. Thus if two reading habits were unequally practiced or effective before the test began, the one which had the less practice might increase in efficiency more than the other during the test period if the period is long enough. The tests used in this study and also by Tinker and Paterson are not exactly like ordinary reading because the subjects were required to cross out one word in every thirty words in addition to ordinary reading processes. This pencil cancellation may have been more of an aid in reading the longer lines than the shorter. The actual speed of reading and cancelling for the average sophomore was approximately 215 words per minute, S. D. 31.3. On a previous study of silent reading of more technical material, (2), similar groups of sophomores averaged approximately 220 words per minute for 25 minutes. Estimates from ten sophomores who answered orally instead of checking the wrong word indicate that the average speed is probably reduced as much as 15 words per minute by the checking process during a ten minute test.

There is probably an optimum length of line for a given gauge and interlinear spacing for a single individual at a single reading, but the individual's practice may change this optimum. Differences between individuals will probably be large enough to show considerable range in the optimum lengths of line.

SUMMARY

This report is based on experiments designed to determine quantitatively the relative legibility of certain printed samples when reproduced by a lithoprinting process. Three problems were attacked separately: size, leading, and length of line. Since the time and energy

available were limited twelve samples were chosen to evaluate common stock forms. Two forms of a fairly reliable ten minute speed of reading test were printed in each type and administered in April and May to approximately nineteen hundred college students.

The results indicate that:

1. There was no reliable difference in the speed and accuracy of reading four sizes of types, 7, 10, 12, and 14 pt. There was an unmeasured tendency for the smaller sizes to be held a little closer to the eyes.
2. There was a slight tendency for the leaded samples to be read more rapidly than the solid, and this tendency is more noticeable in the longer line than the shorter. The mean saving was approximately 3.5 per cent during 10 minute periods.
3. There was a very slight tendency for an 80 mm. line to be read faster than an 176 mm. line, amounting to a mean difference of 1.1 per cent.

The study is not conclusive but it is well controlled considering the technique available. There is a need for more adequate studies along the following lines:

1. The effect of continuous reading over longer periods to evaluate fatigue. Ten minute periods seem to be the longest reported in technical studies. A fifty minute period would probably show somewhat different results.
2. The practice effect. It is quite possible that training with a certain type and gauge will make all others somewhat less legibie. Even the effect of the first test upon the second may be considerable. Several years of training might affect legibility ratings very much.

3. The effect of effort. It seems probable that numbers of students increase the effort if the reading becomes a little harder, thus keeping up their rates. This expenditure of effort is not measurable by any available technique, but future developments may make this possible.

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MENTAL ABILITY OVER A WIDE RANGE OF ADULT AGES

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INTRODUCTION

Almost every study of adult mental abilities that has been reported shows that the mental abilities of adults correlate inversely with age. (1, 2, 3, 4, 5, 6, 7.) When adults are classified into five-year or ten-year age groups, the average measured ability decreases with each successively older age group. The only exception is the writer's study (8). The acme of mental ability generally has been located in the age decade, twenty to twenty-nine. Following this decade a slight but continuous decrease in ability, which usually becomes more pronounced during the late forties or early fifties, is disclosed by nearly all investigations.

DESCRIPTION OF THIS STUDY

This investigation discovered conditions which were exceptions to the general findings of other investigators. Explanations for this fact will be offered after the investigation has been described and its results reported.

At the University of Minnesota fifty-five hundred students who attended the late afternoon and evening classes offered by the General Extension Division were tested by two psychological instruments, a vocabulary test and a reading test.[1] The former test is a one-hour vocabulary test of 480 items. The latter test is a reading test containing a six-minute vocabulary section of 100 items, and

[1] The Minnesota College Aptitude Test and the Minnesota Reading Examination, Form A.

a forty-minute paragraph reading section of thirty-five items. The adults included in this study were measured by a total of one hour and forty-six minutes of testing.

Practically all of these students were employed persons who took university work during their extra-vocational hours. They range in age from the middle teens to seventy. The members of this group of fifty-five hundred adult students were not uniformly distributed over all ages of their age range. There were many more students in their twenties and thirties than of any other ages.

From the total group of fifty-five hundred students, 641 were selected to provide about seventy-five for each five-year age group up to the age of fifty-five. There were only twenty-seven adults of the ages from fifty-five to fifty-nine and eleven from sixty to sixty-nine. The members of each age group were selected on the bases of their years of schooling and of their occupational status.

The years of schooling and occupational status of the members of the 50-54 year age-group set the criteria for selecting the members of the age groups below fifty. With the exception of the 15-19 and 20-24 year-old age groups, it was easy to select adults with the same number of years of schooling and with the occupational status which characterized the members of the 50-54 year group. The younger adults had not reached as high an occupational level as had the older adults, nor had they completed quite as many years of schooling. Thus the younger adults, twenty-four years or less of age, were not as well selected as were the adults over twenty-five years of age. A compensating feature for this condition is the relative recency of the full-time education of the younger adults. In fact a few of them were full-time students who were preparing for positions which rate high vocationally. Table I contains information about the occupational status and years of schooling of the subjects of this study.

THE FINDINGS OF THIS STUDY

Three figures will be given to depict the trend of ability with age. Figure I shows vocabulary scores based on a one-hour test containing four fifteen-minute sections of 120 vocabulary items each. The upper curves are based on the number of words whose definitions were attempted and the lower curves are based on the number of words correctly defined.

Vocabulary ability with one exception increases with each successively older age group. The increases are rather marked. The difference in the mean scores of the 50-54 year-old and 20-24 year-old group is equivalent to .56 of a standard deviation of the scores of the fifty-five hundred students from which the 641 of this investiga-

TABLE I

Years of Schooling and Occupational Status of the Different Age Groups

	Years of Schooling		Occupational Rating[a]			
Age Group	Mean	Median	Mean	Median	Equivalent of Median	Number
15-19	12.8	13	43	37	Stenographer	75
20-24	13.8	14	23	18	Proprietor Manager	75
25-29	13.9	14	18	12	Nurse or Librarian	77
30-34	13.8	14	16	11	Teacher	77
35-39	13.9	14	16	11	Teacher	75
40-44	13.6	14	16	11	Teacher	75
45-49	13.8	14	17	11	Teacher	76
50-54	13.7	14	17	11	Teacher	73
50-59	13.3	14	16	11	Teacher	27
60-70	11.8	12	13	11	Teacher	11

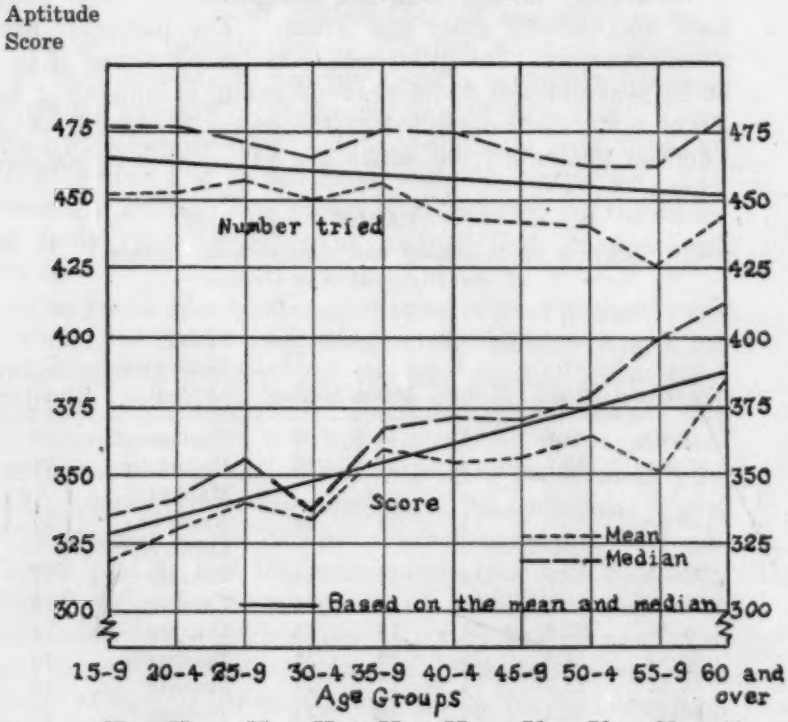
[a] Based on the usual methods by which the professions are given the highest ratings (lowest numerically) and unskilled labor the lowest ratings (highest numerically). Occupations are distributed between these extremes theoretically according to the amount of intelligence they require.

tion were selected. Table II contains data which show the magnitude of the difference in the abilities of two groups separated by thirty years of age.

It will be seen in Figure I that the older more capable adults tried fewer items than did the less capable younger

FIGURE I

Number of Items Tried and Actual Scores on the Minnesota College Aptitude Test by Age Groups



	15-9	20-4	25-9	30-4	35-9	40-4	45-9	50-4	55-9	60 and over
Number	75	75	77	77	75	75	76	73	27	11
Mean Score	320	331	340	332	359	354	356	366	351	387
Median score	335	341	355	335	366	372	372	379	398	412
Mean number tried	452	452	457	449	457	443	441	441	427	443
Median number tried	477	477	470	464	475	474	466	462	462	480

TABLE II

A Comparison of the Abilities of Two Groups Who Differ in Average Age by Thirty Years

	20-29 year-old Group[a]		50-59 year-old Group[b]		Difference of the Median Scores		
	Median Score	P.R. of Median Score	Median Score	P.R. of Median Score	Actual Score	In P.R.	In S.D.
Aptitude Test	347	58	385	79	38.0	21	.55
Vocabulary score (Reading Test)	43	53	54	75	11.0	22	.62
Paragraph Meaning	17.2	60	18.1	69	0.9	9	.20
No. of subjects	152		100				

[a] This group is a composite of the 20-24 and 25-29 year-old groups.

[b] This group is a composite of the 50-54 and 55-59 year-old groups.

Medians, percentile ranks and standard deviations are based on the scores of the fifty-five hundred adult students from which the scores reported in this study were selected.

adults. By comparing the slant of the two smoothed curves of Figure I, one may conclude that if ability were held constant, the older adults would be even slower. A decrease in the speed of response by the older subjects may be caused: (1) by a real decrement of mental ability, (2) by a real decrement of sensori-motor abilities, (3) by being less practiced in testing methods than were the younger students, and (4) by actual fatigue or by disinterest. It is apparent that the older adults even though they were more capable did not work as rapidly as did the younger less capable adults.

Figure II is based on vocabulary scores made in a vocabulary exercise which was a part of the reading test used. This vocabulary exercise was only a six-minute test. The other vocabulary test required an hour.

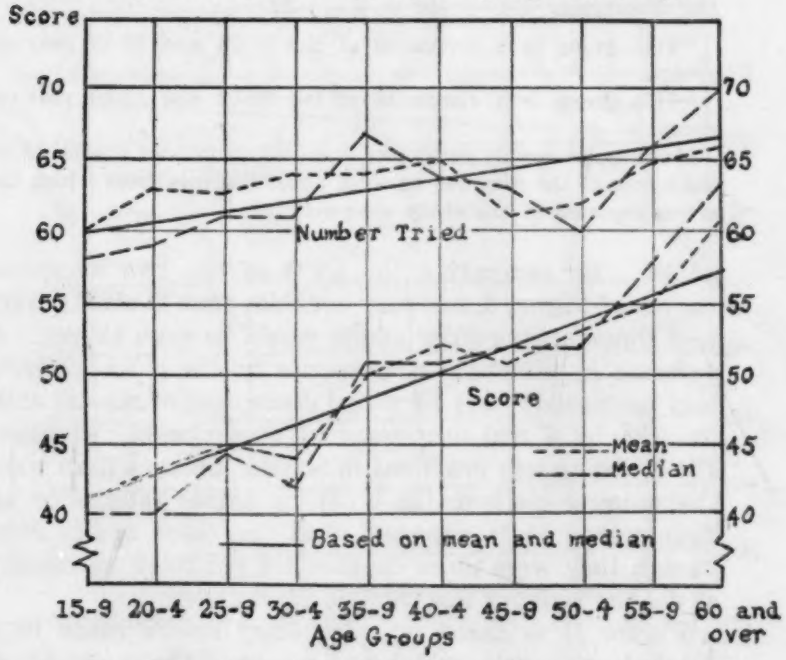
The six-minute vocabulary test was clearly a speed test. The subjects were told to work rapidly but hardly any one had time enough to try all the items. On the

other hand, the vocabulary test of 480 items was not a speed test as many students had ample time to try all the items in it.

It is surprising to find, in view of the results on the one-hour test, that in the short test the older adults tried more items than did the younger. It is possible that the longer test tired the older students. In the shorter test the older persons with a mind set for a short period and

FIGURE II

Vocabulary Scores (on the Reading Test) By Age Groups



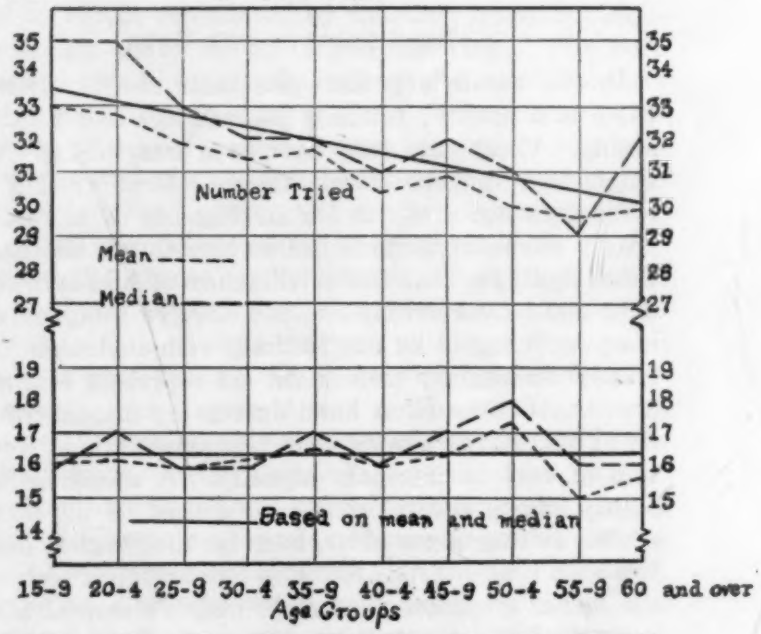
Number	75	75	77	77	75	75	76	73	27	11
Mean score	41	43	45	44	50	52	51	53	55	61
Median score	40	40	44	42	51	51	52	52	58	63
Mean number tried	60	63	63	64	64	65	61	62	65	66
Median number tried	58	69	61	61	67	64	63	60	66	70

aided by better ability actually tried more items than did their younger colleagues. This was not true in the case of the longer test which required sustained attention for a longer period. Consequently the older subjects were penalized by the one hour test.

The importance of these factors may be seen more clearly by an examination of Figure III. The data given in this figure are based on a forty-minute paragraph

FIGURE III

Paragraph Reading Scores, and Number of Answers Attempted, by Age Groups



Number	75	75	77	77	75	75	76	73	27	11
Mean score	16.1	16.2	16	16.2	16.5	16	16.4	17.3	15	15.6
Median score	16	17	16	16	17	16	17	18	16	16
Mean number tried	33	32.7	31.9	31.4	31.6	30.3	30.9	29.9	29.5	29.8
Median number tried	35	35	33	32	32	31	32	31	29	32

reading test. It is a power test calling for thirty-five correct answers to the contents of a number of paragraphs. Almost every college student finds that forty minutes is adequate time for trying all the items. A very good score on this test is twenty-five.

The smoothed line indicates that ability is not higher on the average among the older adults than among the younger. The reading ability curve differs from the curve for vocabulary ability which rises with age. The older adult students, even though they had adequate time to do so, did not attempt as many answers as did the younger students.

Discussion of the Data

In the vocabulary tests the facts clearly show that there is a positive relation between age and vocabulary ability. Vocabulary tests have been described as the best single tests of general intelligence. Possibly this statement does not apply to the intelligence of adults. One hardly dares to venture the statement, on the basis of these findings, that the intelligence of adults increases with age. Conceivably one can acquire a bigger vocabulary by living in an intellectually rich environment. Increased vocabulary then might not represent real mental growth. On the other hand decreasing mental test ability of adults with age may not represent actual detoriora-tion of real or intrinsic capacity. A decrease in test ability among adults probably is caused by the fact that adults, as they grow older, exercise their minds less and less with the materials found in psychological tests. It is the writer's opinion that most people's mental abilities begin to decline with their graduation from high school or college unless a vigorous post-school environment demands active mentation.

The findings of this study indicate that the mental abilities of adults are determined within reasonable limits largely by adult intellectual habits. When adults

activate their minds by going to school, and when their occupations demand more than routine cerebration, adult mental abilities will, at least, maintain themselves over a long span of adult years.

As has been stated before most investigators found that the mental-test abilities of adults decrease with increasing years. Possibly a major cause of a drop in abilities may be explained by habit and opportunity. Adults develop out-of-school habits which inflict a toll on mental efficiency. Mental tests are fair measurements of mental ability for the usual full-time students. The mental capacities of out-of-school adults cannot be interpreted by norms established by full-time students. Mental tests are made up of school materials. The core common to mental tests and a battery of educational tests probably measure the same abilities to the extent of 90 per cent. We need only consider how much and how soon we forget what we are taught to sense how unjust the usual intelligence test is to typical adults who have been out of school for several or more years.

Conrad (9) argues that a general information test is not a good test of adult mental ability because scores on information tests tend to increase with age. Scores on other tests were found to decrease with age. The information test, even though it may not be an ideal intelligence test, is possibly fairer to the adult than other tests which are more closely related to school materials. Adults through normal living are apt to acquire general information. Nevertheless they do not have as good an opportunity to become well informed as do full-time students. Information and vocabulary tests seem to reflect less decrement of adult mental ability with increasing age than do other tests. Might this not show that in the mental functions in which the adult receives some practice, his decrements of ability are smaller than they are in abilities in which adults are severely penalized by disuse or a lack of practice?

The status of adult mental ability at any stated age is controlled to an important extent by training, schooling, or practice. The mentality of pre-adults depends on two major factors. They are: (1) inherent mental growth or maturation, and (2) training, schooling, or practice. Nature helps a pre-adult grow mentally to the age of twenty.[2] When individuals reach that age their intellectual statures are determined. These statures vary, of course, but nature adds very little to intellectual altitudes after twenty. Intellectual ability during adult years depends on native ability plus mental exercise, training, richness of intellectual stimuli, and not a little on mental discipline. Some adults will increase the currency in their intellectual banks, year by year, others will maintain a fairly constant mental level, while most adults through disuse allow their mental abilities to depreciate.

The subjects of this study were engaged in occupations making reasonable demands on their verbal intelligence. Most of them were elementary school and junior high school teachers. They also were part-time university students studying to pass objective and essay examinations. Thus the mental abilities of these adults although not as near par as are the mental abilities of full-time college students, were nearer par than is usually true of adults.

Wright (10) divides intelligence into two categories: (1) the biological, and (2) the complex mental processes. Biological intelligence depends on neurological development. It is inherent and is directly related to the organic basis of intelligence. Intelligence as a function of complex mental processes depends on education, training, teaching, and opportunity to learn. It is acquired intelligence. Intelligence tests measure native intelligence or capacity accurately when the complex mental abilities are equal to biological capacity. In other words, aptitude tests give an index to real, inherent capacity when acquired ability is on a par with capacity to acquire ability.

[2] The age of twenty is probably very near the truth.

Persons who have been out of school are generally not up to their biological capacity for facts, arithmetical skills, verbal abilities, and other abilities measured by intelligence tests. Consequently it is essential that adults be in as rich an intellectual environment as high school and college students are in if adults are to be compared with full-time students in ability. To assume valid age curves such conditions are essential. The nature of the subjects of this study satisfies to a substantial degree the essential conditions for obtaining valid data on adult mental abilities.

The nature of the age curve of reading ability is different from the curve of vocabulary ability. The vocabulary curve shows a decided upward trend with age—a trend which is absent from the reading curve. The latter shows neither an upward nor downward trend.

The failure of the age curve for reading ability to show the upward trend which characterized the age curve for vocabulary ability probably reflects, not the real abilities of adults, but a toll that has been inflicted on mental abilities by the usual adult reading habits. The paragraph reading test was a power and not a speed test. Habits of trying to dig out hard meanings and a willingness to do so are sure to affect appreciably the scores which are obtained on this test. The younger persons who were less remote from their full-time school attendance and its disciplines were more apt to attack with avidity a test requiring long attention spans and continued probings for difficult meanings. Furthermore the younger students' recent school training with its emphasis on preparation for examinations, particularly the objective type, equipped them with efficient habits for taking a paragraph reading test. On the other hand, the older adults with less recent school experience were penalized by the out-of-school reading habits which they had acquired. These same habits which are developed from extensive rather than intensive reading would not penalize the

vocabulary ability of the older students. Thus it is possible for one type of mental ability to deteriorate with years while another improves.

SUMMARY

In this investigation between five and six thousand adult part-time students were tested in two abilities, vocabulary and paragraph reading ability. From this large group were selected 641 adults to provide a uniform distribution according to five-year groupings over the age range from sixteen to seventy. The members of each five-year age group were selected according to years of schooling and occupational status on a basis established by the seventy-three members of the 50-54 year-old group. Thus two very important factors, years of schooling and occupational status, were held constant for all age groups. Furthermore, it was fortunate that persons were studied who attended school. Under these conditions the age curves for vocabulary ability went up with age while the age curve for paragraph-reading ability went neither up nor down.

Theories about mental habits which emphasized use and disuse were advanced to explain to some extent the nature of the curves of adult ability. Most experiments show a decline of abilities with age because the persons studied were out of practice, so to speak, with intelligence test content. On the other hand, the ability curves in this study showed no decline because the subjects of this investigation were more or less in-school subjects and also because years of schooling and occupational status were held constant.

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DETERMINANTS OF FEELING TONE IN TYPE FACES

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In working with type faces in practical advertising one will frequently come upon assertions such as: bold type expresses cheapness, italic types express femininity, or that Bodoni type expresses modernness, and the like, evidently without any proof except the impression made upon the asserter by the characteristic of the type.

In turning to the literature on feeling tones in type faces one finds that some studies have been made on the subject, but that these studies have only touched on a very small part of the possibilities of the field.

Berliner made the first published study.[1] She measured by the order of merit method the relative suitability of 18 styles of hand lettered type for advertising each of four different commodities; namely, fish, pork and beans, pancake flour and orange marmalade. Each person taking part in the experiment was asked to arrange the 18 type faces in an order according to their suitability for expressing the atmosphere of the commodity. To measure the reliability of such a study she gave it to four separate groups and found the correlation between the groups to be as follows:

Fish	.41	Pancake Flour	.62
Pork and Beans	.74	Orange Marmalade	.50

[1] Berliner, A., *Zeitschrift Für Angewandte Psychologie*, 17, pp. 165-172.

Poffenberger and Barrows[2] tested the feeling tone of lines on 500 subjects and give us results such as:

	Feeling	*Appropriate Character of the Curve*
1.	Sad	Slow descending curve
1.	Quiet	Slow horizontal curve
3.	Lazy	Slow descending curve
4.	Merry	Medium rising curve

In this study the lines were presented on cards and each subject was asked to select the line that best fitted the feeling.

Poffenberger and Franken[3] used 29 rather common advertising faces and measured the appropriateness of type faces for both abstract qualities and actual commodities. They used a modified form of the order or merit method and did not, except in a few cases, use the same person to judge more than one commodity. From 40 to 50 judgments were obtained for each of the ten categories. They found no sex differences of any great importance. They measured the specificity of feeling reactions to the type faces by finding the correlations between the orders of the type for different specimens. By the same method they compared concrete and abstract groups. From this they showed that the choices were real and not merely a tendency on the part of the judges to give logical positions to the specimens.

They drew the conclusion that it would be extremely unreliable to take the measure of appropriateness allotted a type by one individual, even though he were an expert at typography. Also they decided that sampling is the only true measure of appropriateness of type, particularly when dealing with the more common featured types.

[2] Poffenberger and Barrows, *Journ. of Applied Psy.*, 1924, VII, pp. 187-205.

[3] *Journ. of Applied Psy.*, 1923, VII, pp. 312-27.

The present study of type faces is along the same lines as the one by Poffenberger and Franken except that in their study they did not take into account the effect of the different mechanical possibilities: size, boldness, condensation, etc., of the same type face and could draw no general conclusions with regard to them.

Other studies found in the literature are not very comprehensive and do not seem of enough practical importance to report.

No study could be found where the different characteristics of the same type face had been studied in regard to their feeling tone.

One might wonder about the feeling tone of the different qualities in type faces making enough difference in the results to be of very practical nature. A checking up in the advertisements for any one product in the magazines, and more particularly in the newspapers, in regard to type faces used, finds wide variations and very little that would approach a standard of style. The general appearance of an advertisement has been proven to have an effect on its pleasantness and unpleasantness and resultant value. If there are definite choices of feeling tone in type faces they would then certainly play a part in the general effect of the advertisement.

In consideration of the above facts, this study was designed to examine the nature and amount of feeling tone to be found in some type faces in rather common newspaper usage. These four problems were held specifically in mind:—

1. To determine the effect of the different variations of mechanical characteristics in the same type face on the feeling tone: namely, boldness, condensation, expansion, italics, and size.

2. To investigate the similarity of choice of type faces of the same family, particularly Caslon and Cheltenham.

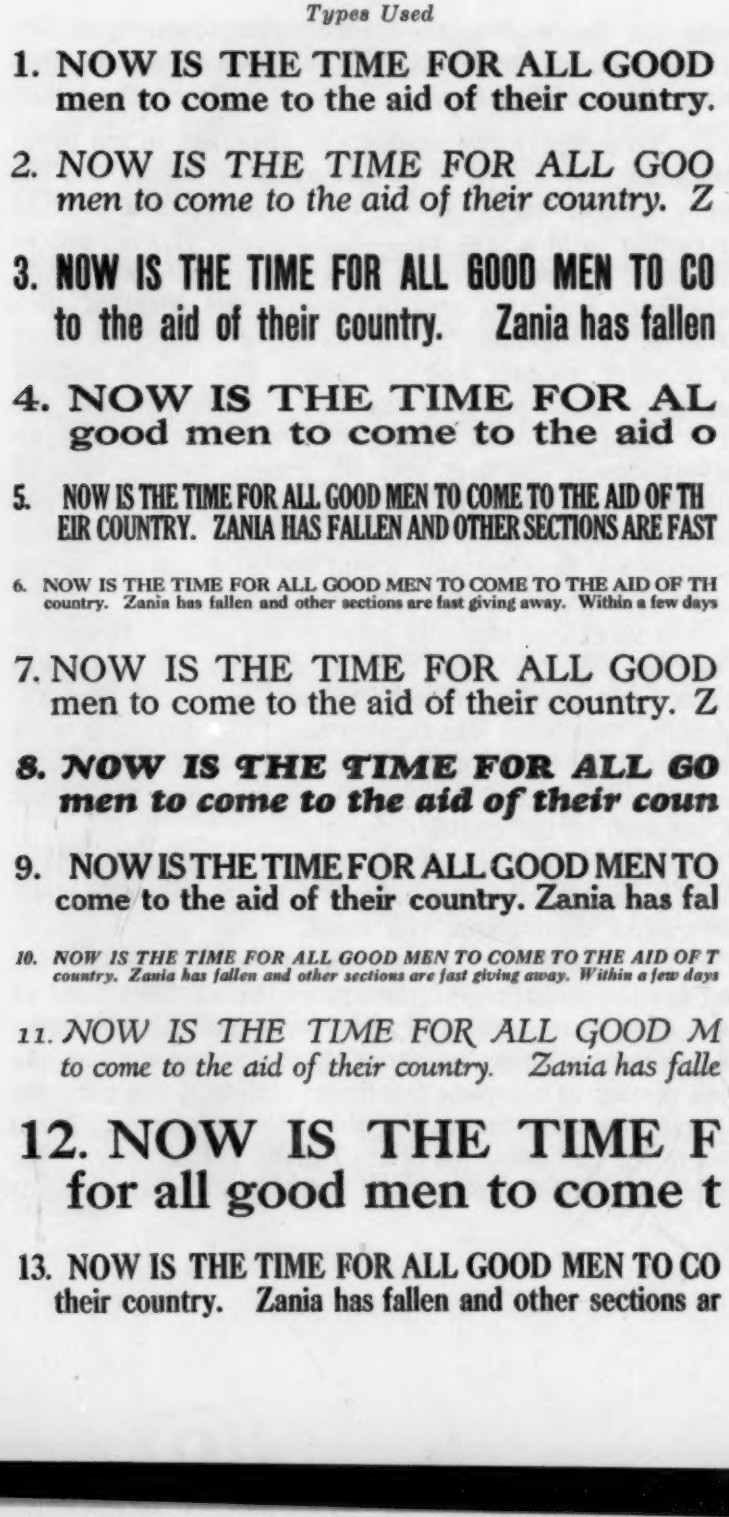
3. To investigate the relative importance of the different characteristics in the selection of a type face to express a feeling tone.

4. To compare two methods of approach to the problem—selecting a type to fit a product or feeling (as the typographical worker has to do) or selecting a product or feeling to fit a type face—and a study of the relative merits of the two methods. As will be seen this duplicate study was also used to discover the effect of such order of arrangement factors as might enter (the effect of primacy, recency and the like). The second method has more psychological authenticity but no previous use of it could be found in the literature. In reading an advertisement one first gets the general feeling tone of the type and then the disclosure of the nature of the message expressed. As this method is used in actual practice the first method would be valid only in so far as it correlated with the second method.

Over 90 college students between the ages of 16 and 38 (average age 20) were used as subjects. Not all students made answers in each case and in case of doubtful marking the choice was thrown out. The questions were submitted to them in a manner as nearly as possible individually so that the choice of one person would not be affected by the choice of another.

Each subject was given a sheet of 13 numbered type faces so arranged as to balance types of opposite characteristics throughout the sheet. (See sample sheet, Fig. 1.) There was no marking on the sheet to indicate the family or nature of these type faces. Two lines of each type were used in regular style capitals and lower case letters with as much of the following sentence as was needed to complete the lines: 'Now is the time for all good men to come to the aid of their country. Zania has fallen and other parts are rapidly giving way." No type was leaded except that leading naturally given it

FIGURE I
Types Used


1. NOW IS THE TIME FOR ALL GOOD men to come to the aid of their country.
2. NOW IS THE TIME FOR ALL GOO men to come to the aid of their country. Z
3. NOW IS THE TIME FOR ALL GOOD MEN TO CO to the aid of their country. Zania has fallen
4. NOW IS THE TIME FOR AL good men to come to the aid o
5. NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF TH EIR COUNTRY. ZANIA HAS FALLEN AND OTHER SECTIONS ARE FAST
6. NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF TH country. Zania has fallen and other sections are fast giving away. Within a few days
7. NOW IS THE TIME FOR ALL GOOD men to come to the aid of their country. Z
8. NOW IS THE TIME FOR ALL GO men to come to the aid of their coun
9. NOW IS THE TIME FOR ALL GOOD MEN TO come to the aid of their country. Zania has fal
10. NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF T country. Zania has fallen and other sections are fast giving away. Within a few days
11. NOW IS THE TIME FOR ALL GOOD M to come to the aid of their country. Zania has falle
12. NOW IS THE TIME F for all good men to come t
13. NOW IS THE TIME FOR ALL GOOD MEN TO CO their country. Zania has fallen and other sections ar

from its base. No type was spaced and the lines were finished wherever the regular count fell without regard even to broken words. Thus, as far as possible, all extraneous mechanical conditions were neutralized. These type faces were used and in this order:—

1. 24 point Caslon Bold
2. 24 point Caslon Italic
3. 36 point Condensed Gothic
4. 24 point Caslon Bold Expanded
5. 24 point Cheltenham Condensed Extra Bold
6. 12 point Century
7. 24 point Caslon
8. 24 point Goudy Bold Italic
9. 24 point Cheltenham Bold
10. 12 point Italic
11. 24 point Oldstyle Italic
12. 36 point Caslon Bold
13. 24 point Caslon Bold Condensed

Then each subject was given a mimeographed sheet on which he wrote his name, sex, and age. These sheets were divided into four sections with the following instructions:—

"1. Select the type you would prefer to see used in a quarter page newspaper advertisement of the following product:—

(Mark the number of the type.)"

This was followed by a list of twenty-three lettered products.

"2. Select the type you would prefer to see used in a quarter page newspaper advertisement to express the following feeling:

(Mark the number of the type.)"

This was followed by a list of twenty-four numbered feelings.

"3. Write under each type on the right-hand side the product from this list for which the type could best be used in a quarter page advertisement."

"4. Write under each type on the left-hand side the quality from this list for which the type could best be used in a quarter page advertisement."

Results from "1" and "2" where the type was selected for the feeling or product will hereafter be called the "Red" results and the method the "Red" method; and those from "3" and "4" where the product or feeling was selected for the type will be called the "Blue" results and the method the "blue" method.

It might be possible that there are some memory effects in the "Blue" results since they were obtained last. Due to the number of choices and the break in time between the two methods for Feelings and the break in time between the two methods for Products this would be expected to be negligible.

At first only 50 cases were used but inspection showed that more cases would be needed for accurate results and over 40 more were added. By the prophecy formula and other devices it was determined that the group was then large enough to be a fair sample of *University students*. There is no reason why highly similar results should not be found in testing the general reading public, but this testing was limited to University students only and the data can be strictly interpreted to apply to that class of persons alone. The first group was about two-thirds men, so the second group was selected to be about two-thirds women. No striking differences were discovered between the reports of the two sexes.

In order to determine the reliability of the data the two groups were compared by finding the coefficients of correlation between the selections of type for each product and feeling for one group and those for the other. Then the averages of these coefficients were

taken (Products .48, Feelings .71). The correlations are not high. (They were taken from rank order coefficients corrected.) The prophecy formula was applied to these averages to predict the correlation if another similar large group was compared, and the results—Products .65, Feelings .83—were obtained. The rank of types below the median where only two or three choices would alter the order doubtless made the correlations much lower than they would have been if only the type choices above the median had been compared. Also only one type choice was made for each product or feeling by each subject and a second or third choice which would be used in the order of merit method might have the effect of making the more desirable types rank higher. Also it must be remembered that some of the differences may be influenced by the predominance of the different sexes in the opposite groups.

The difference between the correlation of Products (after prophecy formula .65) and Feelings (after prophecy formula .83) is noteworthy, and rather unexpectedly indicated that a *product* is more likely to arouse different feelings in different persons. For example, from association one might get a feeling of dirtiness, warmth, labor, darkness, etc., from the product Coal. Likewise, with almost any of the other products. Some of the Feelings described or set out in the list might possibly also get a double interpretation but evidently not to such a degree as the products.

The same comparison of the Blue results yields the average correlations for Products .39 (.56 after prophecy formula) and for Feelings .50 (after prophecy formula .67). Practically the same trends were found that were found in the Red results except that the general group of coefficients of correlation were lower.

A complete list of the raw data was obtained and may be found in Tables I, II, III, and IV.

TABLE I—PRODUCTS

Showing the Original Data for the Number of Choices of Each Type (Red Method) for Each Product

Type ____	1	2	3	4	5	6	7	8	9	10	11	12	13
Product													
A. ____	10	13	7	7	0	5	3	22	8	1	4	8	1
B. ____	4	10	2	10	5	4	6	5	2	9	10	13	4
C. ____	6	9	8	12	6	3	7	9	4	3	8	4	7
D. ____	0	3	0	1	4	3	1	3	0	28	41	1	0
E. ____	12	6	7	11	1	1	3	8	5	0	6	21	3
F. ____	8	6	16	4	11	9	3	3	5	2	2	5	11
G. ____	6	1	14	8	2	2	2	17	5	4	2	19	5
H. ____	6	8	8	7	7	7	6	7	4	5	7	8	4
I. ____	2	5	10	4	3	4	4	14	4	8	4	17	6
J. ____	1	11	0	2	1	6	3	4	1	14	40	1	1
K. ____	4	8	4	7	7	4	9	10	9	2	12	2	4
L. ____	6	3	5	10	3	6	3	8	5	5	6	16	8
M. ____	5	11	12	10	5	0	7	9	6	2	2	10	6
N. ____	0	6	2	4	4	9	4	1	2	15	36	1	1
O. ____	7	5	4	9	12	15	4	8	3	4	4	4	5
P. ____	2	15	0	5	2	11	4	8	3	10	21	0	3
Q. ____	9	4	15	3	10	5	5	8	3	3	2	11	7
R. ____	6	12	7	7	2	4	6	13	3	3	5	12	6
S. ____	9	9	4	9	3	5	5	10	13	4	4	3	7
T. ____	1	3	3	4	0	6	3	2	1	17	40	2	3
U. ____	8	5	12	8	8	9	4	10	2	1	4	8	5
V. ____	4	18	3	1	4	15	6	4	4	7	14	1	3
W. ____	12	11	6	8	7	4	3	1	3	5	5	18	5

TABLE II—FEELINGS

Showing the Original Data for the Number of Choices of Each Type (Red Method) for Each Feeling

Type ____	1	2	3	4	5	6	7	8	9	10	11	12	13
Feeling													
1. ____	2	11	3	4	3	16	4	3	1	12	26	0	0
2. ____	7	6	14	6	6	3	4	9	4	11	3	11	1
3. ____	0	4	1	1	2	3	1	9	0	11	5	2	2
4. ____	8	1	20	2	2	1	0	13	1	1	0	31	5
5. ____	0	3	6	4	13	9	4	6	4	8	3	22	3
6. ____	4	16	2	7	3	5	5	12	3	3	10	7	8
7. ____	1	13	8	6	5	1	7	17	2	4	14	3	5
8. ____	0	1	1	2	7	8	2	9	2	12	36	5	0
9. ____	0	2	1	0	0	6	0	0	0	34	39	2	1
10. ____	7	0	15	6	9	1	1	17	3	0	0	16	12
11. ____	5	15	2	1	2	9	4	2	3	14	15	3	3
12. ____	17	5	9	10	5	4	4	7	5	0	1	13	5
13. ____	8	0	26	6	4	2	5	11	4	1	0	14	3
14. ____	6	12	6	4	3	7	13	8	4	3	12	4	5
15. ____	0	4	0	0	1	5	1	3	0	21	38	1	0
16. ____	5	7	4	4	3	3	4	19	1	6	21	5	2
17. ____	7	15	3	10	3	10	8	4	6	1	11	2	4
18. ____	0	1	14	1	4	1	0	16	0	0	0	48	1
19. ____	8	12	2	10	1	7	7	7	4	9	10	2	4
20. ____	6	4	14	11	4	1	5	9	2	1	1	21	7
21. ____	7	8	3	1	6	6	11	9	3	6	15	4	4
22. ____	7	11	6	6	6	2	2	17	4	2	15	5	0
23. ____	7	6	9	6	12	8	11	1	6	3	3	1	11
24. ____	10	7	9	11	1	5	5	5	8	0	3	19	1

TABLE III—PRODUCTS

Showing the Original Data for the Number of Choices of Each Product (Blue Method) for Each Type

Type	1	2	3	4	5	6	7	8	9	10	11	12	13
Product													
A.	13	7	9	6	1	2	4	14	4	1	0	5	4
B.	6	9	4	5	4	4	4	3	3	4	4	7	1
C.	5	3	4	10	1	2	13	0	3	2	1	1	10
D.	0	1	0	1	1	4	0	1	2	19	14	1	1
E.	9	5	8	7	0	1	4	10	2	0	3	14	1
F.	2	1	14	1	10	0	4	1	2	1	1	4	8
G.	2	3	7	3	3	0	3	6	1	0	1	10	0
H.	5	4	1	2	2	9	3	3	3	2	4	4	1
I.	2	2	4	2	2	3	3	9	2	0	2	9	4
J.	2	6	1	0	2	8	4	2	1	8	19	0	0
K.	0	4	0	6	3	2	2	1	3	1	4	2	6
L.	2	0	2	3	9	3	0	3	2	3	0	4	6
M.	7	3	5	6	2	1	4	4	5	2	0	4	3
N.	0	7	0	2	2	4	5	0	3	7	5	0	4
O.	6	2	3	4	7	11	5	2	4	1	0	0	4
P.	2	4	0	2	1	2	2	1	5	4	2	1	2
Q.	2	2	7	3	8	2	2	6	4	1	2	4	1
R.	4	8	3	7	3	3	2	4	1	1	1	3	6
S.	3	1	3	6	2	1	3	3	7	1	1	2	4
T.	0	0	1	0	0	2	3	3	4	10	9	0	1
U.	4	3	4	5	7	5	5	2	8	2	1	3	3
V.	1	3	1	0	4	7	1	2	1	4	6	0	1
W.	4	4	1	1	1	3	4	0	4	3	2	3	8

TABLE IV—FEELINGS

Showing the Original Data for the Number of Choices of Each Feeling (Blue Method) for Each Type

Type ____	1	2	3	4	5	6	7	8	9	10	11	12	13
Feeling													
1. ____	3	6	1	2	0	6	4	2	0	4	2	0	1
2. ____	17	5	2	2	3	5	2	2	5	1	2	6	3
3. ____	0	3	1	1	0	2	3	0	0	3	17	2	1
4. ____	6	3	11	6	2	0	1	6	6	0	0	12	4
5. ____	0	5	2	4	21	5	3	6	3	9	3	12	3
6. ____	4	7	1	4	2	3	3	3	2	2	0	1	3
7. ____	3	2	2	6	4	1	2	6	1	2	2	1	4
8. ____	0	2	0	0	3	1	1	2	0	1	3	1	0
9. ____	0	0	1	0	0	7	0	0	0	18	16	0	1
10. ____	4	0	8	11	5	3	2	6	7	1	1	7	7
11. ____	0	1	0	1	0	2	1	0	3	5	3	1	3
12. ____	11	3	8	5	6	3	4	4	7	1	0	2	11
13. ____	10	0	8	11	4	2	9	3	8	1	0	7	6
14. ____	2	6	6	4	1	6	14	2	1	5	0	0	2
15. ____	0	3	0	0	1	1	1	1	1	9	17	0	0
16. ____	2	6	5	4	1	2	5	9	2	2	7	1	2
17. ____	3	6	0	4	4	1	4	3	4	3	3	3	3
18. ____	1	1	5	1	2	1	1	6	1	0	0	16	0
19. ____	2	5	2	2	0	7	5	4	4	5	1	1	3
20. ____	5	5	7	3	8	1	2	4	3	1	0	6	3
21. ____	0	4	0	1	2	7	7	4	2	2	3	1	2
22. ____	0	2	1	0	2	0	2	5	4	3	4	0	0
23. ____	3	2	2	3	7	8	6	0	8	1	1	0	4
24. ____	2	1	4	3	1	3	5	4	9	0	2	6	7

To study the degree with which the Red method and the Blue method arrived at the same conclusion, the choices in each case were correlated with the similar case in the other method and Table V gives the results. It is worth noting that in only one case was there a negative correlation and in that case it was not large (Confidence –.11). In general the average correlation between the two methods was moderate. (Average Products .58, Average for Feelings .58.) From this table and from the comparison of the two methods in self-correlation and from handling the data and subjects in the two methods an idea of their value was gained. More cases would be required to get as good correlations in the Blue method as in the Red method. This is due to the number of things to choose from in each case. In the Red method the subjects were choosing a type among 13 to fit the product or feeling; and a product among 23 or a feeling among 24 to fit the type in the Blue method.

After the average of the correlations of the Products had been corrected for attenuation it seems to have been unnaturally raised and should be discounted somewhat on account of the extremely low self-correlation of the products which has been noted before. The difference between the original correlation and the one corrected for attenuation for Products (.58–.97) and for Feelings (.58-.75) indicates that there is more chance error in the data for Products than in that for Feelings, since this correction is a theoretical way to remove the chance choices from the results. In this case the "chance" might be the different possibilities of feeling aroused by the products noted before. Summarizing the comparison of the two methods we have these facts:—

The reliability of the Red method is greater because the possibilities to select from are less. This advantage is, of course, only an accident of the experimental procedure.

TABLE V

Showing the Coefficients of Correlation Between the Results of the "Red" Method and the Results of the "Blue" Method (Group 1 and Group 2 Combined)

PRODUCT	r	FEELING	r
A. Radios	.80	1. Courtesy	.72
B. Cigarettes	.62	2. Confidence	−.11
C. Men's Shoes	.19	3. Beauty	.57
D. Perfume	.66	4. Strength	.83
E. Automobiles	.95	5. Cheap	.74
F. Hardware Tools	.56	6. Appetizing	.38
G. Coal	.58	7. Snappy	.42
H. Candy Bars	.25	8. Sex Appeal	.69
I. Moving Pictures	.48	9. Delicate	.82
J. Formal Dresses	.80	10. Durable	.78
K. Men's Hats	.49	11. Affection for Children	.55
L. Cigars	.78	12. Dependable	.54
M. Refrigerators	.58	13. Masculine	.70
N. Silk Hose	.89	14. Hygiene	.37
O. Typewriters	.57	15. Feminine	.84
P. Fountain Pens	.81	16. Distinctive	.60
Q. Guns	.53	17. Satisfaction	.40
R. Restaurants	.64	18. Danger	.80
S. Golf Clubs	.53	19. Comfort	.45
T. Jewelry	.46	20. Importance	.61
U. Banks	.13	21. Dignity	.61
V. Mirrors	.87	22. Modern	.40
W. Vegetables	.14	23. Precision	.90
		24. Safety	.34
Average Correlation	.58		.58
Correlation after attenuation Correction	.97		.75

TABLE VI

Showing the Total Number and Percentage of Choices for Each Type Face

FEELINGS

Type	1	2	3	4	5	6	7	8	9	10	11	12	13
N	122	164	178	119	105	123	108	213	70	163	327	241	87
%	6.04	8.12	8.81	5.89	5.20	6.09	5.35	10.54	3.64	8.07	16.19	11.93	4.31

PRODUCTS

Type	1	2	3	4	5	6	7	8	9	10	11	12	13
N	129	180	149	151	107	141	101	184	95	152	279	185	105
%	6.58	9.19	7.61	7.71	5.46	7.20	5.16	9.40	4.85	7.76	14.25	9.45	5.36

TOTALS

Type	1	2	3	4	5	6	7	8	9	10	11	12	13
N	251	344	327	270	212	264	209	397	165	315	606	426	192
%	6.31	8.65	8.22	6.79	5.33	6.64	5.25	9.98	4.15	7.92	15.23	10.71	4.83

RANK ORDER

Type No. 11-12-8-2-3-10-4-6-1-5-7-13-9

The Blue method is psychologically more justifiable.

The Red method is psychologically justifiable only in so far as it correlates with the Blue method. In this case this method correlated to the extent of a coefficient of .58 for both Products and Feelings (and with only one negative correlation). The coefficient uncorrected for attenuation must be used as the basis of comparison here, since for practical use it would be necessary to predict a Red score from a Blue.

It may be inferred from the low correlations between the results of the two procedures that there was little effect of the order in which the types were presented or the questions asked. Such an effect would be constant in both situations and would make for a large coefficient.

The possibility of responses being made very much on the basis of memory of answers to questions in the previous method is likewise eliminated by the low correlations found.

To get an idea of the general as opposed to the specific preference for each type, the total choice for each face in all products and feelings was found. In short, each of the 13 columns of the original data was totaled. Then the percentages that those totals were of all totals were figured. The Red method was used in this, of course, for the number of choices of each type would equal the number of choosers in the Blue method. Table VI shows the tabulation of these results. The types were ranked in order of preference and the correlation between this order in Products and that in Feelings was .92. These data give some idea of the general value of each type face within the limits of the products and feelings listed.

To get into comparative form the strength of preference of one characteristic, large size, boldness, etc., over its *opposite or opposites*, types containing the same characteristic were grouped and the total number of choices for each type characteristic in the case of every product and feeling was taken. The Blue tables were used in

TABLE VIIA—PRODUCTS

Number of Times in 100 Each Type Characteristic Would Be Preferred Over Its Alternatives

Product	A	B	C	D	E	F	G	H	I	J
A. Radios	71	29	54	46	38	29	33	49	41	10
B. Cigarettes	45	55	55	45	37	25	39	39	31	30
C. Men's Shoes	57	43	22	78	54	28	18	21	58	21
D. Perfume	10	90	89	11	15	09	76	03	15	82
E. Automobiles	71	29	42	58	46	19	35	68	28	04
F. Hardware Tools	80	20	16	84	07	79	14	70	26	04
G. Coal	74	26	44	56	33	36	31	78	22	00
H. Candy Bars	38	62	49	51	29	17	54	21	28	51
I. Moving Pictures	67	33	49	51	25	37	39	60	28	12
J. Formal Dresses	10	90	81	19	00	16	84	04	32	64
K. Men's Hats	57	43	48	52	61	17	22	18	56	26
L. Cigars	76	24	32	68	29	56	15	34	32	34
M. Refrigerators	71	29	38	62	47	27	26	45	39	16
N. Silk Hose	20	80	69	31	27	27	46	00	47	53
O. Typewriters	48	53	20	30	32	39	29	12	33	54
P. Fountain Pens	38	62	59	41	35	18	47	10	40	50
Q. Guns	70	30	41	59	28	47	25	53	32	15
R. Restaurants	56	44	49	51	50	29	21	33	44	23
S. Golf Clubs	73	27	30	70	52	26	22	38	49	13
T. Jewelry	19	81	82	18	00	16	84	06	25	69
U. Banks	58	42	29	71	38	35	27	31	38	31
V. Mirrors	23	77	67	33	00	44	56	06	25	69
W. Vegetables	38	62	45	55	16	44	40	23	39	38

A. Bold
B. Non-Bold
C. Italic
D. Non-Italic
E. Expanded
F. Condensed
G. Regular
H. Large
I. Medium
J. Small

TABLE VIIB—FEELINGS

Number of Times in 100 Each Type Characteristic Would Be Preferred Over Its Alternative

Feeling	A	B	C	D	E	F	G	H	I	J
1. Courtesy	20	80	65	35	35	12	53	08	28	64
2. Confidence	63	37	46	54	20	28	52	33	40	25
3. Beauty	10	90	84	16	19	14	67	22	41	37
4. Strength	89	11	34	66	40	36	24	75	25	00
5. Cheap	56	44	50	50	25	28	47	36	28	36
6. Appetizing	45	55	55	45	47	21	32	16	47	37
7. Snappy	65	35	52	48	51	30	19	24	52	24
8. Sex Appeal	31	69	76	24	00	44	56	18	46	36
9. Delicate	05	95	89	11	00	14	86	03	12	85
10. Durable	83	17	25	75	39	40	21	52	33	15
11. Affec. for Ch.	29	71	65	35	27	27	46	09	25	66
12. Dependable	75	25	23	77	30	47	23	39	45	16
13. Masculine	75	25	12	88	52	28	20	52	39	09
14. Hygienic	27	73	46	54	38	25	37	25	29	46
15. Feminine	02	98	94	06	00	08	92	00	35	65
16. Distinctive	42	58	69	31	36	26	36	34	45	21
17. Satisfaction	47	53	57	43	42	24	34	21	49	30
18. Danger	85	15	36	64	16	37	47	84	12	04
19. Comfort	33	67	57	43	27	22	51	16	27	57
20. Importance	73	27	40	60	24	51	25	58	33	09
21. Dignity	24	76	70	30	18	23	41	06	35	59
22. Modern	40	60	80	20	00	31	69	11	52	37
23. Precision	49	51	18	82	30	40	30	10	41	49
24. Safety	68	32	28	72	27	39	34	48	36	16

A. Bold
B. Non-Bold
C. Italic
D. Non-Italic
E. Expanded
F. Condensed
G. Regular
H. Large
I. Medium
J. Small

TABLE VIII

Showing the Characteristics that Are Best Suited to Each Feeling and Product. Small Distinctions of Choice Are Omitted and May Be Found By Referring to Tables VIIA and VIIB

Product	1	2	3	4
A. Radios	Bold		Expanded	Large
B. Cigarettes			Regular	Large
C. Men's Shoes		Non-Italic	Expanded	Medium
D. Perfume	Non-Bold	Italic	Regular	Small
E. Automobiles	Bold		Expanded	Large
F. Hardware Tools	Bold	Non-Italic	Condensed	Large
G. Coal	Bold			Large
H. Candy Bars	Non-Bold		Regular	Small
I. Moving Pictures	Bold		Regular	Large
J. Formal Dresses	Non-Bold	Italic	Regular	Small
K. Men's Hats			Expanded	Medium
L. Cigars	Bold	Non-Italic	Condensed	
M. Refrigerators	Bold	Non-Italic	Expanded	Large
N. Silk Hose	Non-Bold	Italic	Regular	Small
O. Typewriters		Non-Italic		Small
P. Fountain Pens	Non-Bold		Regular	Small
Q. Guns	Bold		Condensed	Large
R. Restaurants			Expanded	Medium
S. Golf Clubs	Bold	Non-Italic	Expanded	Medium
T. Jewelry	Non-Bold	Italic	Regular	Small
U. Banks		Non-Italic	Expanded	Medium
V. Mirrors	Non-Bold	Italic	Regular	Small
W. Vegetables	Non-Bold		Expanded	Medium

TABLE VIII (Continued)

Feeling	1	2	3	4
1. Courtesy	Non-Bold	Italic	Regular	Small
2. Confidence	Bold		Regular	Medium
3. Beauty	Non-Bold	Italic	Regular	Medium
4. Strength	Bold	Non-Italic	Expanded	Large
5. Cheap			Regular	
6. Appetizing			Expanded	Regular
7. Snappy	Bold		Expanded	Medium
8. Sex Appeal	Non-Bold	Italic	Regular	Medium
9. Delicate	Non-Bold	Italic	Regular	Small
10. Durable	Bold	Non-Italic	Condensed	Large
11. Affection for Ch.	Non-Bold	Italic	Regular	Small
12. Dependable	Bold	Non-Italic	Condensed	Medium
13. Masculine	Bold	Non-Italic	Expanded	Large
14. Hygienic	Non-Bold		Expanded	Small
15. Feminine	Non-Bold	Italic	Regular	Small
16. Distinctive		Italic	Regular	Medium
17. Satisfaction			Expanded	Medium
18. Danger	Bold	Non-Italic	Regular	Large
19. Comfort	Non-Bold		Regular	Small
20. Importance	Bold	Non-Italic	Condensed	Large
21. Dignity	Non-Bold	Italic	Regular	Small
22. Modern	Non-Bold	Italic	Regular	Medium
23. Precision		Non-Italic	Condensed	Small
24. Safety	Bold	Non-Italic	Condensed	Large

tabulation because all type faces had to be used an equal number of times in that method and the total type preference as noted in Table VI would not affect the results. The Blue method was used also because it appears to be the best method, psychologically. The results were changed to percentages by dividing the number of people selecting a characteristic for a feeling by the total number of people selecting any characteristic for the feeling.

Because some type characteristics were presented quite a few more times than others, unbalanced ratios would have been expected if pure chance had governed the distribution. To take this into account the percentage of times a characteristic was chosen for a feeling was divided by the number of times that characteristic was presented for choosing (expressed by the percentage of times out of 13 that that characteristic was found).

These ratios expressed as percentages are given in Tables VIIA and VIIB. To repeat, Tables VII show the number of times out of 100 that each characteristic was chosen in comparison with the opposite or opposites for its group when, in theory, each characteristic was presented the same number of times. The groups are (1) Bond—Non-bold; (2) Italic—Non-italic; (3) Expanded—Condensed—Regular; and (4) Large—Medium —Small.

To make these results more readable Table VIII, a verbal tabulation, was made. After each feeling and product are given the characteristics reported by the subjects to suggest it. In cases where the choice between opposite pairs was such that neither scored over 60 per cent they were not included in the table. Where there were three opposites any score of less than 37 per cent was not included. Such small distinction may be found by referring to Tables VIIA and VIIB.

A correlation of the number of selections of each type face with the number of selections of each other type face (the intercorrelations of the orders) was made

TABLE IX

A Chart Showing the Coefficients of Correlation of Each Type Face with Each Other Type Face

1.	1.													
2.	.03	2.												
3.	.56	—.48	3.											
4.	.31	.25	.41	4.										
5.	—.04	—.32	.39	.10	5.									
6.	—.22	.39	—.70	—.19	.00	6.								
7.	.36	.71	.00	.52	.20	.31	7.							
8.	.02	—.27	.42	.07	.28	—.71	—.58	8.						
9.	.70	.28	.30	.72	.29	.25	.67	—.29	9.					
10.	—.80	—.13	—.45	—.84	—.12	.28	—.29	—.42	—.55	10.				
11.	—.54	.39	—.89	—.48	—.28	.52	—.02	—.39	—.34	.47	11.			
12.	.19	—.77	.68	.19	.23	—.72	—.34	.51	.04	—.46	—.78	12.		
13.	.43	.05	.39	.41	.17	—.29	.51	.28	.29	—.47	—.58	.35	13.	
A1	.57	.02	.61	.64	.02	—.32	.24	.10	.49	—.73	—.21	.60	.61	A1
A2	.41	—.06	.39	.49	.79	.30	.37	.02	.79	—.39	—.83	.21	.28	.36

Average r = .0056.

A1—Caslon Average Types 7-1-12-4-13-2.

A2—Cheltenham Average Types 5-9.

Average Correlations of Types with Others of Same Characteristic

36 point	.68	Cheltenham	.29	Non-Bold	.26
24 point	.11	Caslon	.21	Condensed	.32
12 point	.28	Bold	.30	Italic	—.06

throughout the Red Feelings. Each type face was correlated with each other. This was done to indicate whether a particular characteristic, such as large size, would cause all types possessing it to be chosen for the same purposes. To find this the type faces with a given characteristic should be compared with those having the opposite, and with the average correlation for all (.0056). Table IX gives the results. To make this comparison there should ideally be examples of all possible combinations of variables in the type series selected. That would naturally be impossible, but care was taken to select types so that the characteristics varied as independently as possible through the series.

From these tabulations may be drawn the conclusion that the following characteristics and in this order are most influential in determining choices (within the limits of the type faces used) :—Extreme size, Condensation, Boldness, Family Style, and Italics. The negative correlation of the Italic types may be largely due to the fact that a Goudy Bold Italic type face was used. This explanation, however, only verifies the assertion that boldness is more important than italics in arousing feeling tone. A comparison of this order with the frequency with which the various type characteristics appear in Table VIII, an index of the same thing, shows close agreement and serves as a check on the accuracy of the method.

Conclusions (Itemized)

1. The Blue method, where the product or feeling is chosen to fit the type face is the more justifiable of the two, psychologically and statistically.
2. The following characteristics and in this order are the most forceful in expressing feeling tone in these type faces: Extreme size, condensation, boldness, family style, and italics.
3. Characteristics as expressed in Table VIII are best adapted for use in the feelings and products tested.

OBJECTIVE MEASUREMENT OF APPLIED INFORMATION

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General Statement

Psychology has established definitely that the reasoning processes can be well trained only when there has been an accumulation of facts as raw materials. Given a problem, the manner by which the reasoning processes reach the solution is to recall certain pertinent facts, choose two or more alternative answers, each in the light of factual information and past experiences, and then select the most logical response or conclusion.

This factual information is tested scientifically today by means of objective tests. Literally hundreds of well standardized educational tests are on the market. Most teacher training courses lay stress upon the construction of these new-type tests, and through them teachers have been able to prognosticate the student's ability to master factual information.

However, the teacher's ability to predict vocational success has not been as marked. For example, much has been written regarding the present impossibility of predicting with a high degree of accuracy the teaching success of students after they complete their training in professional schools. Perhaps prediction of teaching success would be much higher if the teaching were more similar to the learning processes, the results of which are measured while the students are in college. Greater reliability in prediction will take place in so far as measures or techniques are developed for the measure-

ment of the ability to apply knowledge to practical problems, as well as a clearer meaning of good teaching and a measure of such.

The Problem and Procedure

During an investigation* of evaluating the effectiveness of different teaching techniques in the course of educational psychology in one of the middle western state universities, there arose the problem of measuring the ability of students to apply their knowledge to specific school problems. It was thought that the traditional multiple-choice or true-false type of test item did not measure the ability to apply knowledge to specific problems. That is, this type of item did not allow sufficient selectivity in the solution of a school room problem, and moreover, it did not allow the students to evaluate their answers in comparison with other solutions. The multiple-choice item is well adapted to the objective measurement of factual information. It also is possible to construct test items of this type wherein the student must use judgment in the selection of the *best answer* to the question being asked. However, after a student has answered a test item of this character he is unable to compare its relative value with other possible solutions to the problem and at the same time have its relative value put up in such a form that it may be scored objectively.

After considerable experimentation the following general method of construction and scoring of the results appeared to give the most reliable results. A list of specific school problems concerning learning or teaching was obtained from the seven members of the staff. The average number of years teaching experience for this group was nine and each had one or more years experience in public school work. Another list of problems

* A report of the results of this work appears in the *Journal of Educational Psychology*, Vol. XXIV, No. 4, pp. 283-302.

was obtained from teachers of experience who attended the summer session in 1930. A committee of staff members selected from this list about sixty of the best problems. Each problem was described in a paragraph ranging from thirty to two hundred words. Then each problem was given five solutions. Some of the solutions were supposedly good, while others were mediocre or poor. It may be well to give a sample problem so that the scoring of it may be more clearly described.

PROBLEM

A high school student who is called on for a recitation answers several times that he "knows the assignment but can't express his thoughts." You suspect this to be a "stall" in which case you should

Answers for Student A	B	Key	
5	2	(3)	ask another pupil to recite in his place.
1	1	(2)	answer the question for him.
3	5	(5)	ask the question again in a different way.
5	3	(3)	tell him to study it some more and you will call on him tomorrow.
3	1	(1)	politely tell him you know he is not telling the truth.

Twenty of these problems along with two hundred multiple-choice questions were included in each of the initial and final tests of the research referred to previously.

The following directions were given to the students:

Following is a list of twenty specific school problems. Each is based on some one or more topics covered in educational psychology. After each problem are a number of solutions, some of which may be very good, some of which may be very poor, and others just mediocre. Proceed as follows: carefully read the problems, then WEIGHT each solution on the basis of 5 points. A weighting of 5 means a very good solution; 4 a good solution; 3 a fair solution; 2 a poor solution; and 1 a very poor solution. Be sure to have at least one (5) and at least one (1) among your completed weightings. Otherwise, you are permitted to use the same weighting over as many times as you desire.

A scoring key was constructed by taking the average of the weightings given by the seven members of the staff. Whenever two or more staff members deviated more than two points from the other members on a particular solution, that solution was revised or discarded. The attainment of a completely satisfactory scoring key is difficult when judgment enters into the results. However, whenever there is no scientific evidence covering the solution to a specific problem we must rely upon a concensus of expert opinion for the best solution.

From this point on the results may be handled in an objective manner. A student's score is the number of points he deviates from the scoring key. Thus, if student "A" weights the first solution (5) to the problem just given, he deviates two points from the key; if he weights the second solution (1) he deviates one point from the key; if he weights the other three solutions (3), (5), and (3) respectively he deviates two points from the key for each of these solutions. Student "A" then has a total deviation of nine points from the scoring key. In like manner, student "B" deviates one point on the first solution and one point on the second, and he agrees with the key in the other three answers. His total deviation is two points as compared to nine for student "A." Therefore, in a distribution of scores for a class on judgment problems, the highest deviations would represent the poorest solutions and the lowest deviations would represent the best solutions. A student may weight all his solutions too high in which case all his deviations would be plus. Should he weight them too low his deviations would be minus. Ordinarily the sign may be disregarded in obtaining a summation of the deviations. However, if the direction in which a student deviates from the scoring key is taken into consideration it is possible to determine whether he con-

sistently evaluates the solutions too high or too low. This type of analysis is valuable for remedial instruction.

Several other methods of student weighting were used before the method just described was found to be the most reliable. In the beginning the students were asked to rank the answers in the order of importance. With this method it was found that the students selected the best and poorest solutions and that the rankings of the other three were governed by chance. Next the students were directed to weight the solutions on the basis of five points using any weighting as many times as they deemed it wise. Many weighted all the solutions extremely low or extremely high but at the same time were unable to substitute good solutions to the problem when they considered that all those given were very poor. The method which was finally adopted gave the most reliable and consistent results.

RESULTS

In this report the results obtained from the judgment problems will be compared to the results obtained from tests of the multiple-choice type which had two hundred items each.

The coefficients of reliability of the various multiple-choice tests ranged from .90±.009 to .94±.004. When the judgment problem test (twenty problems in length with one hundred items to be evaluated) was administered at the end of the course, the coefficient of reliability was .76±.02. This coefficient was obtained by correlating the scores on the ten odd numbered problems with the ten even numbered problems and corrected by the Brown Spearman formula. If this test had been doubled in length, so that the number of items to be evaluated compared with the number of multiple choice questions, the coefficient of reliability would have been raised to .86±.01 according to the Brown Spearman formula. When the

test was administered at the beginning of the course the coefficient of reliability was .94±.004. It is most difficult to account for the decrease in the coefficient from the beginning to the end of the course. The only tentative explanation that can be given now is that the students at the beginning of the course had to weight the solutions on the basis of past experience, which was more or less a trial and error process.

At the end of the course for the nineteen different classes which had been taught by seven different instructors the coefficient of correlation between the scores on the multiple-choice items and the scores on the judgment problems ranged from .59±.06 to .67±.05. According to these coefficients it may be said that there is considerable relationship between the two types of results. However, if the multiple-choice items emphasized factual information, which they undoubtedly did, it cannot be said that the students who revealed a high ability of factual knowledge are always best in applying this knowledge to specific problems.

Between the intelligence test percentiles and scores on the judgment problems, for twelve classes taught by five instructors, the range of coefficients of correlation was from .23±.10 to .31±.09. These coefficients indicate a consistently low relationship between these two variables. The relationship between intelligence percentiles and the multiple-choice questions were in the neighborhood of .51±.08. It was found consistently that the relationship between intelligence and ability to answer multiple-choice questions correctly was somewhat higher than between intelligence and ability to evaluate the solutions to the judgment problems.

Since the problems were scored on the basis of the number of points a student deviated from the scoring key the question may be asked as to what would happen if a student had weighted each solution with the same number throughout? Analyzation of the possibilities

from this angle gives the following results: if a student had weighted each of the one hundred solutions, (1), his score on the test would have been 172; a weighting of (2) for each solution would have given him a score of 147; a weighting of (3), a score of 132; a weighting of (4) a score of 167; and a weighting of 5, a score of 216. Obviously no one did this since the lowest score out of 523 students was 127 and only five students received more than 113 points deviation.

There was a slight tendency for the students to weight the solutions too high. Fifty-seven per cent of the students had more plus deviations than minus deviations.

Less than one per cent of the students scored higher on the problems than the lowest score obtained by a group of twelve university instructors. Each of these instructors had taught more or less recently a course in educational psychology. This would tend to indicate that there appears to be some relationship between teaching experience and the ability to score high on this type of judgment problem test.

Bearing on Educational Research

Since rapid progress has been made during the last decade in the reliable measurement of factual material, increasing attention should be directed upon the measurement of the ability to apply learned facts to practical problems. The technique which has been described in the foregoing pages is a definite attempt in this direction. In so far as we become capable of evaluating in an objective manner the ability to apply information to the solution of specific problems we will be able to predict with a higher degree of accuracy the probable success of students preparing for teaching, medicine, law, or any vocation where success is somewhat dependent upon the ability to apply scientific knowledge to practical problems.

NEWS AND NOTES

Dr. James F. Abel, chief of the foreign schools systems division of the United States Office of Education, has made an interesting study comparing the school populations in Soviet Russia and the United States. In Russia a total of 34,788,000 individuals are in one kind of school or another, distributed as follows: 7,000,000 children in preschool institutions; 24,000,000 in elementary schools; 1,437,000 in workers' faculties and technical high schools; 1,200,000 in factory apprenticeship schools; 506,000 in workers' training courses; 115,000 in party and communist universities; 500,000 in high schools; and 30,000 workers in the scientific institutions. The total figure for the United States is around 30,818,000, divided into pre-school, 770,000; elementary 23,482,000; secondary, 5,512,-000; and collegiate 1,154,400. The population of the Soviet Union for 1931 was 161,000,000; that of the United States in 1930, 122,775,000.

The University of Minnesota Testing Bureau announces a scoring service for the Strong Vocational Interest Blank to those who have quantities of these blanks to be scored. The Hollerith Tabulating Machine is used for this purpose at the rate of $1.00 per test for twenty-six keys. Further information may be obtained from E. G. Williamson, Director.

A recent study of the pulp and paper industry made by the Vocational Education Division of the Federal Office of Education places much emphasis on the increasing need for a vocational training program which will fit prospective workers for specific occupations which, at the same time, requires a general knowledge of many other fields. "Too few persons realize," says Dr. George F. Zook, United States Commissioner of Education, "that the average job in a manufacturing plant requires more than mere brawn, a knowledge of a particular operation, or an ability to handle a certain set of tools efficiently." The study includes the analysis of 208 jobs connected with the pulp and paper industry. Two examples given are those of the pulp tester and the millwright who, in addition to their specific jobs, must also possess mechanical skill, an elementary knowledge of statistics, accounting, stationary engineering, chemistry and physics.

A National Conference on the Education of Negroes to be held in the spring will consider some of the special problems arising in the education of Negroes, assist in synthesizing and coordinating their various educational activities and agencies, and in better relating them to life's needs. The Conference will be directed by Dr. Ambrose Caliver, Federal Office of Education specialist in the education of Negroes.

Secretary of the Interior, Harold L. Ickes, recently announced the union of two major Federal agencies concerned with the promotion of education in the United States. The functions of the Federal Board for Vocational Education are transferred to the U. S. Office of Education in the Department of the Interior. Dr. George F. Zook, U. S. Commissioner of Education, will direct the activities of the enlarged Federal Office of Education. "Both Commissioner Zook and I have long been deeply interested in vocational education and we both propose to promote the development of this highly important part of the field of education vigorously," said Secretary Ickes. The Federal Office of Education since 1867 has studied education in all of its phases in the United States, public and private, from the nursery school level to adult and parent education. As a fact-gatherer it serves as the central educational census agency for the United States. It has also conducted numerous researches which have guided the way toward the improvement of education.

Dr. Moises Saenz, of Mexico City, was the guest of honor at the Educational Conference held on November 25 in the Mary Reed Library at the University of Denver. The Conference was under the direction of the Foundation for the Advancement of the Social Sciences and the Division of Education and Psychology. It had for its topic of discussion: "What are the Functions of the Schools in America in our Social and Economic Reconstruction?" Dr. Saenz, who is an authority upon the educational and cultural life in Mexico and also upon the arts and crafts of the Indians of the American continents, was in Denver as the special speaker for the lectures sponsored by the Cooke-Daniels Foundation.

School and college administrators who are interested in helping students to choose their careers more wisely, and who wish information to assist them in planning programs of vocational guidance, may get such information without charge from the National Occupational Conference, 522 Fifth Avenue, New York City.

What is a good high school? How can a good high school be made a better one? How may the effectiveness of a high school

be evaluated? How can high schools be stimulated to better progress? Such questions will be answered in a thorough study of accrediting standards and procedures planned for America's 4,600 secondary schools on the accredited lists of regional accrediting associations, to be made by the Committee for Cooperative Study of Secondary School Standards and Accrediting Procedures, of the Federal Office of Education. The significance of inclusion on an accredited list is much the same to a high school as high rating by a commercial agency is to a commercial firm. The committee will emphasize stimulation of schools to improve their services far beyond minimum requirements.

The Midwestern Psychological Association will hold its ninth annual meeting as guests of Purdue University, Lafayette, Indiana, May 10-12, 1934, under the presidency of Dr. J. J. B. Morgan. Correspondence concerning the meeting may be addressed to the secretary, Dr. John A. McGeoch, Department of Psychology, University of Missouri, Columbia, Missouri.

BOOK REVIEWS

ARMSTRONG, CLAIRETTE P. *660 Runaway Boys.* Why boys desert their homes. Boston: Richard G. Badger. 1932. pp. 208. $3.00.

This study, by the psychologist of the Children's Court, New York City, of a group of boys charged with deserting their homes is a very interesting and valuable statistical study of a special group of delinquents.

Cases taken in sequence from the files of the clinics in Manhattan and Brooklyn mostly between the years 1926-1930 constitute the group. In the many statistical studies this group is compared with smaller groups of "incorrigible" and "unlawful entry" delinquents and non-delinquent public school children all studied by the author, as well as with other groups of delinquents reported in the literature.

Statistical analyses are made of the following factors, to each of which a chapter is devoted: (1) The delinquent: chronological age, test performance, nationality, education, nervous habits, physical defects, previous court experience and institutional experience. (2) The family: economic level, marital status, number of children, overcrowding, social pathology. (3) The offense: concomitant offenses, petitioner, companions, number and length of desertions, season, whereabouts, institutions deserted and the boy's reason for deserting. In addition there are twenty-six very short histories of typical cases.

Two factors in the etiology of running away are brought into strong relief in this study. First is the part played by the home. Broken homes were found in over half the cases and in a still greater number the domineering of parents, overwork, lack of consistent discipline, etc., played important parts. In this connection the author pointedly says, "Surely the parents are to blame for a child's disobedience, waywardness, incorrigibility and even running away from home. Why are not the parents held responsible in Court for their failure, not the boy?"

The other factor earlier referred to is the school. The evidence indicates that some 55 per cent of these boys were placed in a grade too high for their ability and only 13 per cent were in ungraded classes. Thus the school, in shortsightedly insisting upon its formal system, is in part responsible for these maladjusted children.

KARPMAN, BEN. *Case Studies in the Psychopathology of Crime.* Washington: Mimeoform Press. 1933 pp. x 1042. $12.00.

Over one thousand badly printed pages devoted to the case histories of five patients at the Department for the Criminal Insane (Howard Hall) at St. Elizabeth's Hospital—this surely is a stupendous work. Yet after reading every one of these pages one has the feeling that something is lacking.

The reader would like to have, at least briefly, the psychiatrist's interpretation. The section of "diagnostic impressions" in the case of Albert Thornley (No. 4) is such interpretation, and even the three pages devoted to it makes the case much more valuable to the non-psychiatric reader. In the preface the author says: "In particular, as the present volume is addressed mainly to a public that has no direct interest in refined psychiatric diagnosis and intimate psychiatric discussions, such interpretations have in the main been omitted." To the reviewer this seems fallacious reasoning because it is just the non-psychiatric public who will need some interpretations to make the cases useful. The promise of a second volume to be concerned with an "intimate psychogenetic discussion of the material" indicates that the author is not trying to avoid the difficult task of interpretation. Yet to keep in mind 1000 pages of detailed case material so that x pages of interpretation in a separate volume will be understandable seems nearly an impossibility.

Adverse criticism of this book must be based on the omissions. The material presented evidences a great amount of careful labor and will prove its usefulness in many ways. A few minor matters are disconcerting to the reader, e. g., we read in one official record; "Not liking Colorado, he journeyed to Chicago and worked in the Kankakee Hospital until December 1920[11]". Upon looking for the note some 150 pages further on we find, "An official letter from the latter institution states he never worked there." Here we have one of the few justifiable occasions when footnotes should be used so that the reader is immediately aware that there is a discrepancy. Also why the discrepancy? If the fact of his being at a certain place could not be objectively checked then certainly it should not appear as part of the official record without some indication of its doubtfulness. Such instances are to be found in many places in the histories. The one quoted is merely an illustration of the loose organization in the writing.

One final word. Surely for $12.00 one could expect a reasonably made book. Typographically this is quite horrible. It is questionable if either galley or page proofs were ever read—misspelling, crooked lines, and many such typographic errors are easily found.

C. M. LOUTTIT,
Indiana University.

NEW BOOKS AND PAMPHLETS

Books and pamphlets for review should be sent to James P. Porter, Editor, Journal of Applied Psychology, Ohio University, Athens, Ohio.

Eighth Annual Report of the Commission on Scholastic Aptitude Tests—1933. College Entrance Examination Board, New York City. 24 pp.

An Experimental Study of Factors Influencing Consonance Judgments. EUGENE GOWER BUGG. Psychological Monographs, Vol. XLV, No. 2, 1933. Psychological Review Company, Princeton, N. J. 100 pp.

Classroom Organization and Management. FREDERICK S. BREED. World Book Company, Yonkers, N. Y. 472 pp.

How to Appreciate Motion Pictures. EDGAR DALE. Macmillan Company, New York City, 1933. $1.20. 243 pp.

The Illiteracy of the Literate. H. R. HUSE. D. Appleton Company, New York City, 1933. $2.00. 273 pp.

Instruction in the Social Studies. WILLIAM G. KIMMEL. Bulletin No. 19, 1932, United States Department of the Interior. Office of Education, Washington, D. C. 10 cents. 105 pp.

Introductory Lectures to Psychoanalysis. SIGMUND FREUD. W. W. Norton & Company, New York City, 1933. $3.00. 257 pp.

The Meaning of Right and Wrong. RICHARD C. CABOT. Macmillan Company, New York City, 1933. $2.50. 463 pp.

The Measurement of Artistic Abilities. NADALINE KINTER. Psychological Corporation, New York City, 1933. 90 pp.

Motion Pictures and the Social Attitudes of Children. RUTH C. PETERSON and L. L. THURSTONE. Macmillan Company, New York City, 1933. $1.50. 142 pp.

Movies and Conduct. HERBERT BLUMER. Macmillan Company, New York City, 1933. $1.50. 257 pp.

Movies, Delinquency and Crime. HERBERT BLUMER and PHILIP M. HAUSER. Macmillan Company, New York City, 1933. $1.50. 233 pp.

Procedures in Curriculum Making. EDWIN S. LIDE. Office of Education, U. S. Department of the Interior, Bulletin No. 17, 1932, Washington, D. C. 10 cents. 99 pp.

Programs of Guidance. WILLIAM O. REAVIS. U. S. Department of the Interior, Bulletin No. 17, 1932. 10 cents. 144 pp.

Provisions of Individual Differences, Marking and Promotion. ROY O. BILLETT. U. S. Office of Education, Bulletin No. 17, 1932, Washington, D. C. 40 cents. 472 pp.

The Reorganization of Secondary Education. FRANCIS T. SPAULDING, O. I. FREDERICK and LEONARD V. KOOS. U. S. Office of Education, Washington, D. C., 1933. 40 cents. 423 pp.

Selection and Appointment of Teachers. W. S. DEFFENBAUGH and WILLIAM H. ZEIGEL, JR. National Survey of Secondary Education, Monograph No. 12, U. S. Office of Education, Washington, D. C. 10 cents. 115 pp.

The Smaller Secondary Schools. EMERY N. FERRISS, W. H. GAUMNITZ, P. ROY BRAMMELL. National Survey of Secondary Education, U. S. Government Printing Office, Bulletin No. 17, 1932, Washington, D. C. 15 cents. 236 pp.

Studies in the Psychology of Art. NORMAN C. MEIER and others. University of Iowa Studies in Psychology, No. XVIII. Psychological Review Company, Princeton, N. J., 1933. 188 pp.

INDEX OF SUBJECTS

Titles of books are followed by the name of the author of the work reviewed. All other references are to original articles.

Ability, native races, Alaska, mechanical, physical, musical, 493; ——, native races, Alaska, mental, 417; —— over wide range, adult ages, mental, 729; ——, subnormal boys, mechanical, 164; —— to wake, specified hour, study, 468.

Achievement, native races, Alaska, educational, 646; —— predicted, American Council Psychological Examinations, differential college, 637.

Adjectives, feeling tone, 63.

Adjustment and mastery (Woodworth), 489.

Adult ages, mental ability, wide range, 729.

Advertisements, experiment, colored and uncolored, 49; ——, factors influencing amount, copy read, magazine, 195.

Ages, mental ability, wide range, adult, 729.

Alaska, educational achievement, native races, 646; ——, mechanical, physical, musical ability, native races, 493; ——, mental ability, native races, 417.

America, Jewish musicality, 675.

American business leaders (Taussig and Joslyn), 344.

American Council Psychological Examination, differential college achievement predicted, 637.

Apprehension, reading, experimental study, visual, 266.

Attention, preschool children, intelligence, causal factor determining difference in sustained, 478.

Attitude tests, development, interests, 1.

Attitudes, Indians, degrees Indian blood, study, emotional, 410; ——, interests, Indian and white children, comparative study, emotional, 227; ——, juvenile delinquency, experimental study, 522.

Audience, habits, radio, 29.

Battery of tests, attempt to predict success, student nurses, by use, 277.

Beliefs, college students, religious, 585.

Bernreuter personality inventory, not measure, 559.

Blind children, tactual recognition, embossed pictures, 148.

Blood, emotional attitudes, Indians, degrees of, 410; ——

pressure, intelligence, scholarship, personality, other measures, university women, intercorrelations, metabolic rate, vital capacity, 507.
Boys, comparison, IQ's, three mental tests, incarcerated delinquent, 581; ——, mechanical ability, subnormal, 164.
Business conditions, sanity of a population, effects, 130.

Capacity, blood pressure, intelligence, scholarship, personality, other measures, university women, intercorrelations, metabolic rate, vital, 507.
Case studies in the psychopathology of crime (Karpman), 776.
Children, comparative study, emotional attitudes, interests, Indian, white, 227; ——, honesty tests, rural white children, Indian, 120; ——, intelligence, causal factor determining differences, sustained attention, preschool, 478; ——, tactual recognition, embossed pictures, blind, 148.
Children's intelligence scores, parental occupations, 103.
Citizenship, study, factors contributing to school, 459.
Clerical positions, relationship, certain factors, success, 55.
College achievement, predicted, American Council Psychological Examination, differential, 637; —— courses, affective selectivity, liberalizing influence, 349; —— marks, teaching success, students, teachers college, predicting, 439; ——, predicting marks, teaching success, students in teachers, 439; —— probationers, study, scholastic progress, 39; —— students, photographic eye-movement records, successful, unsuccessful, 604; —— students, religious beliefs, 585; —— thinks, war and peace, 17.
Colored, uncolored advertisements, experiment, 49.
Constancy, Stanford-Binet, Herring-Binet IQ's, comparative, 475.
Constant, comparative study, IQ's, Heinis' personal, 355.
Correlation, standard error, average intercorrelation, average criterion, 70.
Courses, affective selectivity, liberalizing influence, college, 349.
Criminology (Gault), 214.
Criterion correlation, standard error, average intercorrelation, average, 70.
Curves, Japanese work, 331.

Diagnosing personality and conduct (Symonds), 215.
Delinquency, experimental study, attitudes, juvenile, 522.
Development, Indians, different tribes, comparison, emotions, 535.
Differences, speed of reading sex, 221; ——, sustained attention, preschool children, intelligence, causal factor determining, 478.
Dramatic personality of Jesus, the (Dunlap-Gill), 489.

Ellis memory, objects test, standardization, 68.
Embossed pictures, blind children, tactual recognition, 148.
Emotional attitudes, Indians, degrees, Indian blood, 410; —— attitudes, interests, Indian, white children, comparative study, 227; —— development, Indians, different tribes, comparison, 535.
Engineering motives, inventory, 302.
Error, average intercorrelation, criterion correlation, standard, 70.
Examination, differential college achievement predicted, American Council Psychological, 637.
Experiment, transfer, training, class, 77.
Experimental investigation of eye-movement in learning to spell words, (Gilbert) 490.
Eye-movement records, successful, unsuccessful college students, photographic, 604.

Faces, determinants, feeling tone, type, 742.
Fatigue, influence, noise, production, 320.
Feebleminded, predictive value, Kuhlmann-Binet scale, inmates of state school, 188.
Feeling tone, type faces, determinants, 742.

Handbook of child psychology (Murchison), 630.
Heinis' personal constant, comparative study, intelligence quotient, 355.
Herring-Binet IQ's, comparative constancy, Stanford-Binet, 475.
Honesty tests, rural white children, Indian children, 120.

Imagery tests, experiment, map scoring, mental, 376.
Indian blood, emotional attitudes of Indians, different degrees, 410; —— children, honesty tests, rural white, 120; ——, white children, comparative study, emotional attitudes, interests, 227.
Indians, degrees, blood, study, emotional attitudes, 410; ——, different tribes, comparison, emotional development, 535.
Information, objective measurement, applied, 765.
Inmates, state school for feebleminded, predictive value, Kuhlmann-Binet scale, 188.
Inner speech, reading maximum, minimum, 182.
Intelligence, relationship, play, 294; ——, scholarship, personality, other measures, university women, intercorrelations, metabolic rate, vital capacity, blood pressure, 507; —— scores, parental occupations, children's, 103.
Intercorrelation, average criterion correlation, standard error, average, 70.
Interest-attitude tests, development, 1.
Interests, Indian, white children, comparative study, emotional attitudes, 227.

Inventory, not measure, Bernreuter personality, 559.
Investigation, broadcasting versus lecturing in psychology, preliminary, 317.
IQ's, comparative constancy, Stanford - Binet, Herring-Binet, 475; —— Heinis' personal constant, comparative study, 355; ——, three mental tests, delinquent boys, comparison, 581.

Juvenile delinquency, experimental study of attitudes, 522.

Kuhlmann-Binet scale, inmates, state school for feeble-minded, predictive value, 188.

Learning, configurational psychology, 83; ——, experiment, number maze, measure, 614.
Lecturing in psychology, preliminary investigation, broadcasting versus, 317.
Liberalizing influence, college courses, affective selectivity, 349.

Magazine advertisements, factors influencing amount, copy read, 195.
Managing minds (Allen and Tremann), 99.
Map scoring, mental imagery tests, experiment, 376.
Marks, teaching success, students, teachers college, predicting college, 439.
Maze, measure of learning, experiment, number, 614.
Measure, Bernreuter personality inventory, not, 559; —— of learning experiment, number maze, 614.
Measurement, applied information, objective, 765.
Measuring psychological phenomena, scale, 239.
Memory, objects test, standardization, Ellis, 68.
Mental imagery tests, experiment, map score, 376; —— tests, incarcerated delinquent boys, comparison of IQ's, 581.
Metabolic rate, vital capacity, blood pressure, intelligence, scholarship, personality, other measures, university women, intercorrelations, 507.
Motion pictures, motion analysis, use of stereoscopic, 407.
Motives, inventory, engineering, 302.
Multiple choice, objective question, multiplying possibilities, 337.
Musical ability, native races, Alaska, mechanical, physical, 493; —— talent, four new tests, 136; —— talent, validity and reliability, tests, 447.
Musicality, America, Jewish, 675.

Native races, Alaska, educational achievement, 646; —— races, Alaska, mechanical, physical, musical ability, 493; —— races, Alaska, mental ability, 417.
New type test, term paper, experimental comparison, 621.
Noise, production and fatigue, influence, 320.

Number maze, measure of learning, experiment, 614.
Nurses, battery, tests, attempt to predict success, student, 277; ——, selection, student, 564.

Objective question, multiplying possibilities, multiple choice, form, 337.
Objects test, standardization, Ellis memory, 68.
Occupations, children's intelligence scores, parental, 103.
Our neurotic age (Schmalhausen), 345.

Peace, college thinks, war, 17.
Perceptivity, trade test, muscular, 550.
Personal constant, comparative study, intelligence quotient, Heinis', 355.
Personality inventory, not measure, Bernreuter, 559; ——, other measures, university women, intercorrelation, metabolic rate, vital capacity, blood pressure, intelligence, scholarship, 507.
Phenomena, scale, measuring psychological, 239.
Physical, musical ability, native races, Alaska, 493.
Pictures, blind children, tactual recognition, embossed, 148; ——, motion analysis, stereoscopic motion, 407.
Play, intelligence, relationship, 294.
Population, effects of business conditions, sanity, 130.
Positions, relationship, certain factors, success, clerical, 55.
Predict success, student nurses, battery of tests, attempt, 277.
Preschool children, intelligence, causal factor determining differences, sustained attention, 478.
Probationers, study, scholastic, college, 39.
Production and fatigue, influence, noise, 320.
Progress, college probationers, study, scholastic, 39.
Psychological Examination, differential college achievement predicted, American Council, 637; —— phenomena, scale, measuring, 239.
Psychologists, study, turnover, 542.
Psychology of learning, configurational, 83; ——, preliminary investigation, broadcasting versus lecturing, 317.

Question, multiplying possibilities, multiple-choice form, objective, 337.
Quotient, Heinis' personal constant, comparative study, intelligence, 355.
Quotients, three mental tests, incarcerated delinquent boys, comparison, intelligence, 581.

Races, Alaska, educational achievement, native, 646; ——, Alaska, mechanical, physical, musical ability, native, 493; ——, Alaska, mental ability, native, 417.
Radio audience, habits, 29.
Range of adult ages, mental ability, wide, 729.

Reading, experimental study, visual apprehension, 266; ——, maximum and minimum, inner speech, 182; ——, sex differences, speed, 221.
Recognition, embossed pictures, blind children, tactual, 148.
Reliability, tests, musical talent, validity, 447.
Research and teaching device, interview, 205.
Rural white children, Indian children, honesty tests, 120.

Sanity, population, effects of business conditions, 130.
Scale, inmates of state school for feebleminded, predictive value, Kuhlmann-Binet, 188.
Scholarship, personality, other measures, university women, intercorrelations, metabolic rate, vital capacity, blood pressure, intelligence, 507.
Scholastic progress, college probationers, study, 39.
School citizenship, study, factors contributing, 459; —— for feeble-minded, predictive value, Kuhlmann-Binet scale, inmates of state, 188.
Scores, parental occupations, children's intelligence, 103.
Scoring, mental imagery tests, experiment in map, 376.
Script, legibility, typewriter, 713.
Selectivity, liberalizing influence, college courses, affective, 349.
Sight singing, predicting success, 671.
Singing, predicting success, sight-, 671.
Six Hundred Runaway Boys (Armstrong), 775.
Speech in reading, maximum, minimum inner, 182.
Speed of reading, sex differences, 221.
Standardization, Ellis memory, objects test, further, 68.
Stanford-Binet, Herring-Binet IQ's, comparative constancy, 475.
State school for feebleminded, predictive value, Kuhlmann-Binet scale, inmates, 188.
Stereoscopic motion pictures, motion analysis, 407.
Student nurses, use of battery of tests, attempt, predict success, 277; —— nurses, selection, 564.
Students, photographic eye-movement records, successful, unsuccessful, college, 604; ——, religious beliefs, college, 585; ——, teachers college, predicting college marks, teaching success, 439.
Subnormal boys, mechanical ability, 164.
Success, clerical positions, relationship, certain factors, 55; ——, sight singing, predicting, 671; ——, student nurses, battery of tests, prediction, 277; ——, students, teachers, college, predicting college marks, teaching, 439.
Successful, unsuccessful, college students, photographic eye-movement records, 604.

Talent, four new tests, musical, 136; ——, validity and reliability, tests, musical, 447.

Teachers college, predicting college marks, teaching success, students, 439.
Teaching device, interview as research, 205; —— success, students, teachers college, predicting college marks, 439.
Term paper, experimental comparison, new type test, 621.
Test, muscular perceptivity, trade, 550; ——, standardization, Ellis memory, objects, 68; ——, term paper, experimental comparison, new type, 621.
Tests, attempt to predict success, student nurses, by use of battery, 277; ——, development, interest-attitude, 1; ——, experiment, map scoring, mental, imagery, 376; ——, incarcerated delinquent boys, comparison, IQ's, three mental, 581; ——, musical talent, four new, 136; ——, musical talent, validity and reliability, 447; ——, rural white children, Indian children, honesty, 120.
Time, study, ability to wake, specified, 468.
Tone of adjectives, feeling, 63; ——, type faces, determinants, feeling, 742.
Trade test, muscular perceptivity, 550.
Training, class experiment, transfer, 77.
Transfer, training, class experiment, 77.
Tribes, comparison of emotional development, Indians different, 535.
Turnover, psychologists, study, 542.
Type faces, determinants, feeling tone, 742.
Typewriter script, legibility, 713.

University women, intercorrelations, metabolic rate, vital capacity, blood pressure, intelligence, scholarship, personality, other measures, 507.
Unsuccessful, college students, photographic eye-movement records, successful, 604.

Value, Kuhlmann-Binet scale, inmates, state school for feebleminded, predictive, 188.
Vibrato, the, studies in the psychology of music teaching (Seashore), 632.
Visual apprehension, reading, experimental study, 266.
Vital capacity, blood pressure, intelligence, scholarship, personality, other measures, university women, intercorrelations, metabolic rate, 507.

Wake, specified time, study of ability, 468.
War and peace, college thinks, 17.
White children, comparative study, emotional attitudes, interests, Indian, 227; —— children, Indian children, honesty tests, rural, 120.
Women, intercorrelations, metabolic rate, vital capacity, blood pressure, intelligence, scholarship, personality, other measures, university, 507.
Work curves, Japanese, 331.

INDEX OF AUTHORS

The names of authors of original contributions are printed in Capitals and Small Capitals.

ADAMS, H. F., 239.
Anderson, Amos C., 490.
ARTHUR, GRACE, 188.
BEERS, F. S., 182.
BERMAN, ISABEL R., 221.
BIRD, CHARLES, 182, 221.
BOYNTON, PAUL L., 294.
BRAMKAMP, JOSEPHINE D., 459.
BROOM, M. E., 459.
BROTEMARKLE, R. A., 559.
Burtt, Harold E., 100, 215.
CHADWICK, J. ELBERT, 671.
CHARLES, C. M., 581.
CURETON, EDWARD E., 70.
CURRY, MARCUS A., 130.
DAVIS, R. C., 742.
DRAKE, RALEIGH M., 136, 447, 633.
DUDYCHA, GEORGE J., 585.
DULSKY, STANLEY, 195.
DUREA, MERVIN A., 522.
EELLS, WALTER CROSBY, 417, 493, 646.
ELDERTON, MARION, 376.
EURICH, ALVIN C., 604.
FORD, ADELBERT, 407.
FORD, F. A., 294.
FRITZ, RALPH A., 439.
GARDNER, DOROTHY A., 331.
GARTH, THOMAS R., 331.
GASKILL, HAROLD V., 317.
GAUDET, FREDERICK, 130.
Gentry, John R., 347.
GERBERICH, J. R., 637.
GILBERT, H. NELSON, 49.
GREENE, EDWARD B., 713.
HABBE, STEPHEN, 564.
HARTMANN, GEORGE W., 205.
HILDEN, ARNOLD H., 355.
HOLCOMB, G. W., 302.
IKEDA, KUNEHEI, 331.
JORDAN, A. M., 103.
KAPLUN, DAVID, 63.
KERR, WILFRED H., 550.
KINNEY, L. B., 55.
KITSON, HARRY DEXTER, 542.
LAIRD, DONALD A., 320.
LEHMAN, HARVEY C., 77, 218.
LITTERER, OSCAR, 266.
LORANZ, MARGARET, 468.
Louttit, C. M., 631, 776.
LUMLEY, F. H., 29.
MCCLUSKY, HOWARD Y., 621.
MCELWEE, EDNA WILLIS, 68.
MCGEOCH, JOHN A., 83.
MERRY, FRIEDA KEIFER, 148.
MERRY, RALPH V., 148.
NEMZEK, CLAUDE L., 475.
OMWAKE, KATHARINE T., 468.
PAGE, MARJORIE LOU, 164.
PATRICK, JAMES R., 507.
PRESSEY, LUELLA COLE, 1, 120, 227, 410, 535.
PRESSEY, SIDNEY L., 1, 120, 227, 410, 535.
REMMERS, H. H., 349.
RHINEHART, JESSE BATLEY, 277.
ROGERS, H. S., 302.

ROWLES, EMMETT, 507.
SALNER, E., 349.
SCHEIDEMANN, NORMA V., 337.
SEGEL, DAVID, 637.
SHACTER, HELEN S., 478.
SMELTZER, C. H., 765.
SMITH, HANSEL J., 742.
SMITH, JOHN J., 17.
SORENSON, HERBERT, 729.
SWARD, KEITH., 675.
Tinker, Miles A., 491.
WAGNER, ROBERT P., 614.
WEINLAND, JAMES D., 550.
WHITMER, CARROLL A., 39.

Directory of American Psychological Periodicals

(Continued)

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(Continued on Third Cover)